

FORMER FRONTIER HARD CHROME

EVENT 23 ON-PROPERTY WELLS GROUNDWATER MONITORING REPORT



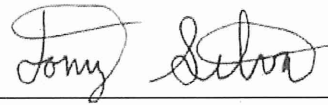
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GRAND BOULEVARD INVESTMENTS, LLC
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*The material and data in this report were prepared
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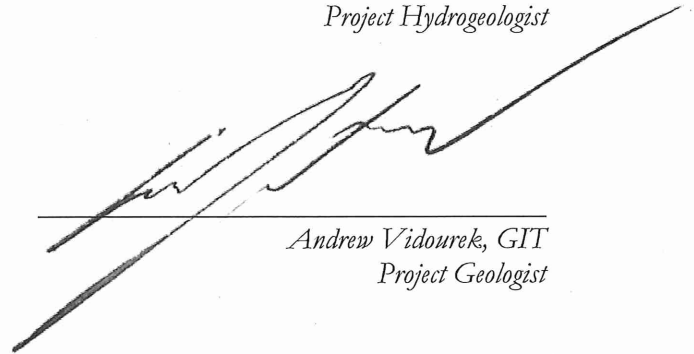


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CONTENTS

TABLES AND ILLUSTRATIONS	IV
ACRONYMS AND ABBREVIATIONS	V
1 INTRODUCTION AND BACKGROUND	1
1.1 INTRODUCTION	1
1.2 BACKGROUND	2
1.3 PROBLEM DEFINITION	2
1.4 MONITORING SCHEDULE	3
2 SAMPLING ACTIVITIES AND RESULTS	4
2.1 MONITORING WELL SAMPLING PROCEDURES	4
2.2 SUMMARY OF ANALYTICAL RESULTS	5
2.3 GROUNDWATER FLOW DIRECTION AND ELEVATION	5
2.4 QUALITY ASSURANCE AND DATA VALIDATION	6
2.5 INVESTIGATION-DERIVED WASTE	6
2.6 DISCUSSION AND CONCLUSIONS	6
LIMITATIONS	
REFERENCES	
TABLES	
FIGURES	
APPENDIX A	
SAMPLE PLAN ALTERATION FORM	
APPENDIX B	
FIELD SAMPLING DATA SHEETS	
APPENDIX C	
LABORATORY ANALYTICAL RESULTS	
APPENDIX D	
DATA VALIDATION MEMORANDUM	

TABLES AND ILLUSTRATIONS

FOLLOWING REPORT:

TABLES

- 2-1 GROUNDWATER ANALYTICAL RESULTS
- 2-2 WATER QUALITY FIELD PARAMETERS
- 2-3 WATER QUALITY PARAMETERS
- 2-4 WATER LEVEL ELEVATIONS—JUNE 2016
- 2-5 QUALITY ASSURANCE ANALYTICAL RESULTS

FIGURES

- 1-1 MONITORING WELL LOCATIONS
- 2-1 GROUNDWATER ELEVATION DATA—JUNE 2016

ACRONYMS AND ABBREVIATIONS

AMSL	above mean sea level
DO	dissolved oxygen
Ecology	Washington State Department of Ecology
IDW	investigation-derived waste
ISRM	in situ redox manipulation
Leidos	Leidos, Inc.
MFA	Maul Foster & Alongi, Inc.
mg/L	milligrams per liter
MRL	method reporting limit
mS/cm	millisiemens per centimeter
mV	millivolts
ORP	oxidation-reduction potential
pH	potential hydrogen
PPE	personal protective equipment
the property	113 Y Street, Vancouver, Washington
RA	remedial action
site	former Frontier Hard Chrome site
ug/L	micrograms per liter
USEPA	U.S. Environmental Protection Agency
Weston	Weston Solutions, Inc.

1 INTRODUCTION AND BACKGROUND

1.1 Introduction

On behalf of Grand Boulevard Investments, LLC, Maul Foster & Alongi, Inc. (MFA) conducted groundwater sampling at 113 Y Street, Vancouver, Washington (the property). The property is one of several properties that are within the former Frontier Hard Chrome site (the site). Monitoring wells for the site include both on-property monitoring wells and off-property monitoring wells. The property is currently owned by Grand Boulevard Investments, LLC.

The property previously comprised four lots, which have recently been consolidated to one parcel, Clark County Tax Account Number (b) (6). The U.S. Environmental Protection Agency (USEPA) and the Washington State Department of Ecology (Ecology) required groundwater sampling of 11 on-property monitoring wells before well decommissioning and property development (Ecology, 2016). Grand Boulevard Investments, LLC, intends to develop the property after groundwater sampling and monitoring well decommissioning.

This report describes the sampling activities performed and analytical results obtained during Event 23 sampling of on-property groundwater monitoring wells. Sampling activities for Event 23 on-property wells were conducted by MFA on June 27 and June 28, 2016. On-property monitoring wells are shown on Figure 1-1 (Weston, 2014). Bill Ryan and Bernie Zavala of the USEPA, were on site to observe the groundwater sampling of the on-property monitoring wells.

Off-property monitoring well sampling was conducted by Weston Solutions, Inc. (Weston) in September 2016. Reporting for the off-property monitoring wells will be provided by Weston under separate cover.

USEPA approved the decommissioning of the on-property monitoring wells to take place after the monitoring well sampling (USEPA, 2016). Monitoring well decommissioning activities were conducted September 12 to 16, 2016. A summary of well decommissioning activities will be provided under separate cover.

The site was the subject of a remedial action (RA) conducted in September 2003. The purpose of the RA was to treat chromium-contaminated soil and groundwater. Long-term monitoring was required to track plume concentrations as well as to show that the remedy maintained its operational functionality (Weston, 2014).

The first three groundwater monitoring events (Events 1 through 3) were conducted for the USEPA. In October 2004, responsibility for the site was turned over to Ecology. Ecology contracted Weston to conduct Events 4 through 19. Weston conducted Events 20 through 22 under a Prime Contract between Leidos, Inc. (Leidos) and Ecology. The work for these events reportedly was performed in accordance with the project work plan (Weston, 2004).

1.2 Background

The property is located in section 25, township 2 north, range 1 east, of the Willamette Meridian in Clark County, Washington.

The property historically was occupied by several metal-fabricating businesses. In addition, the property historically was used for storage and as a staging area for adjacent facilities. As of June 2016, there is one building on the southwest corner of the property. The property, has a chain link fence and is used for equipment and vehicle storage. The property encompasses approximately 0.5 acre and is bordered to the north by a scrap metal facility, to the east by a building occupied by JH Kelly, to the south by Fred Meyer, and to the west by Y Street (Figure 1-1).

The property was occupied by chrome-plating facilities between approximately 1958 and 1983. The property was first developed circa 1958 with the addition of hydraulic dredge fill material and construction rubble. Pioneer Plating operated at the property from approximately 1958 to 1970 and Frontier Hard Chrome operated at the property from approximately 1970 to 1983. Between approximately 1958 and 1976, untreated process wastewater from the facility, which included hexavalent chromium and other heavy metals, was discharged to the City of Vancouver's sanitary sewer system (Weston, 2014).

Circa 1976, the City of Vancouver and Ecology requested that the facility cease discharging all chromium-contaminated wastewaters to the municipal system. Subsequent to this request, Frontier Hard Chrome began discharging the untreated chromium-contaminated wastewater to an on-property "dry well," and continued this practice for approximately seven years. In December 1982, the site was proposed for inclusion on the National Priorities List under the Comprehensive Environmental Response, Compensation, and Liabilities Act. Frontier Hard Chrome terminated its operations in January 1983 (Weston, 2014).

Work began on the remedial design for the site in October 2001 and was completed in February 2003. The RA, which consisted of building demolition, treatment of source area soil and groundwater, and installation of an in situ redox manipulation (ISRM) treatment wall, was completed in September 2003 (Weston, 2014).

1.3 Problem Definition

The goal of the RA was to treat source area soil and groundwater to reduce hexavalent chromium concentrations such that groundwater downgradient of the site would attenuate to total chromium concentrations of less than 50 micrograms per liter (ug/L). To demonstrate this, groundwater quality was monitored in two areas:

- The first area consisted of wells located within and downgradient of the ISRM treatment wall; these wells were monitored to ensure the continued operational functionality of the ISRM wall (Weston, 2014).

- The second area consisted of the historical chromium-contaminated groundwater plume located downgradient of the ISRM wall. This plume, which did not receive treatment during the RA, was monitored to track the long-term expected reduction in total chromium concentrations as a result of the elimination of the source of hexavalent chromium and the ISRM wall (Weston, 2014).

Long-term groundwater monitoring was required by the Record of Decision for the site. Additional information regarding regulatory actions related to the site is available at the USEPA Region 10 Cleanup Sites Web site: <http://yosemite.epa.gov/R10/cleanup.nsf/sites/cleanuplist>.

1.4 Monitoring Schedule

Groundwater sampling and monitoring events were conducted approximately quarterly by USEPA for the first year after completion of the RA. Planned events were conducted in February, April, and August 2004. The sampling event performed in August 2004 concluded approximately one year of monitoring after the RA was completed (Weston, 2014).

In September/October 2004, monitoring of the site was turned over to Ecology. Sampling of the site groundwater for Ecology took place in May and December 2005 under the original contract with Weston. In February 2006, Ecology amended Weston's contract (Amendment No. 1) to require six additional rounds of quarterly monitoring—in March 2006, June 2006, September 2006, December 2006, March 2007, and June 2007 (Weston, 2014).

In July 2007, funding was received from Ecology for an additional eight quarters of groundwater monitoring (Amendment No. 3). These additional quarterly monitoring events were scheduled for September 2007, December 2007, March 2008, June 2008, September 2008, December 2008, March 2009, and June 2009 (Weston, 2014).

In June 2008, as a result of the recommendations of the Long-Term Monitoring Optimization study (USEPA, 2008), Ecology issued Amendment No. 4 to Weston, removing the remaining rounds of sampling from the contract with the exception of a single event to be conducted in September 2008. The work of September 2009 (Event 15), September 2010 (Event 16), September 2011 (Event 17), October 2012 (Event 18), and April 2013 (Event 19) was conducted under individual authorization/contracts. The work of December 2013 (Event 20), April 2014 (Event 21), and October 2014 (Event 22) was conducted under a subcontract agreement between Weston and Leidos and was authorized by Ecology under Leidos's prime contract (Weston, 2014).

This report documents the results of the June 2016 sampling event, which is the Event 23 on-property monitoring well monitoring. The USEPA and Ecology agreed to authorize the property owner, Grand Boulevard Investments, LLC, to sample the on-property monitoring wells because of ongoing property development.

2 SAMPLING ACTIVITIES AND RESULTS

2.1 Monitoring Well Sampling Procedures

Sampling activities for Event 23 on-property monitoring wells were conducted on June 27 and June 28, 2016, by MFA staff consistent with the long-term monitoring plan (Weston, 2004) and the Sample Plan Alteration Form approved by USEPA on June 21, 2016 (see Appendix A). Eleven monitoring wells were sampled and are shown on Figure 1-1.

Well purging and sampling (using low flow sampling methodology) were performed with a peristaltic pump equipped with new polyethylene tubing deployed to mid-screen depth at each well. The wells were purged prior to sampling until monitored water quality field parameters (turbidity, conductivity, potential hydrogen [pH], dissolved oxygen [DO], oxidation-reduction potential [ORP], and temperature) stabilized. A flow through cell was used during well purging. The water quality field parameter readings were recorded on field sampling data sheets, which are included as Appendix B.

Consistent with the USEPA-approved Sample Plan Alteration Form (Appendix A) and at the direction of Ecology (Ecology, 2016), the samples were analyzed for total chromium. Samples from RA-MW-12A and RA-MW-15B were analyzed for dissolved chromium. The sample from RA-MW-12A was also analyzed for total and dissolved hexavalent chromium, dissolved sulfur, and total sulfate. Laboratory analyses included the following:

- Total and dissolved chromium by USEPA Method 6010C
- Total and dissolved hexavalent chromium by USEPA 7196
- Dissolved sulfur by USEPA Method 6010C
- Total sulfate by USEPA Method 300.0

Dissolved chromium, dissolved hexavalent chromium, and dissolved sulfur samples were field-filtered with a 0.45-micron filter.

Samples were sent to Specialty Analytical (Specialty) in Clackamas, Oregon for analyses. Specialty performed all analyses with the exception of the dissolved sulfur, which was analyzed by Spectra Laboratories in Tacoma, Washington, due to Specialty not having the capability to analyze for dissolved sulfur at the time samples were submitted. The results are included as Appendix C.

Groundwater sample concentrations are summarized in Table 2-1. Measured water quality field parameters are summarized in Table 2-2.

2.2 Summary of Analytical Results

2.2.1 Chromium

Total chromium was detected above the laboratory method reporting limit (MRL) in two of the 11 wells sampled. These wells included B85-3B (0.130 ug/L) and RA-MW-12A (7.48 ug/L, qualified as estimated). RA-MW-12A had a detection of dissolved chromium (1.13 ug/L) above the MRL. The reporting limits for total chromium and dissolved chromium were 0.100 ug/L.

Neither total nor dissolved (field-filtered) hexavalent chromium was detected in RA-MW-12A at or above the MRL of 5 ug/L.

2.2.2 Sulfur and Sulfate

RA-MW-12A was analyzed for dissolved sulfur and sulfate. The sulfate concentration was 1,220 milligrams per liter (mg/L) and the dissolved sulfur concentration was 11 mg/L. The detections are relatively consistent with previous sample results (see Table 2-3).

2.2.3 Water Quality

DO concentrations measured during the Event 23 on-property monitoring well sampling ranged from 0.05 mg/L in well RA-MW-12A to 2.90 mg/L in well W92-16B.

The groundwater ORP measured during the Event 23 on-property monitoring well sampling ranged from -290.9 millivolts (mV) in well RA-MW-12A to 48.1 mV in well W92-16B.

The groundwater specific conductivity measured during the Event 23 on-property monitoring well sampling ranged from 0.170 millisiemens per centimeter (mS/cm) in well W92-16B to 2.243 mS/cm in well RA-MW-12A.

The groundwater pH measured during the Event 23 on-property monitoring well sampling ranged from 5.52 in well RA-MW-16A to 7.07 in well RA-MW-12A.

Water quality data from this event are presented in Table 2-2. Table 2-3 summarizes water quality data from previous sampling events as well as from Event 23 on-property monitoring wells.

2.3 Groundwater Flow Direction and Elevation

Groundwater surface elevations were determined using the known elevation of the top of each well casing and the depth-to-groundwater measured in each monitoring well. The measured groundwater surface elevations ranged from 6.70 feet AMSL in well RA-MW-12C to 10.82 feet AMSL in well RA-MW-12A. Groundwater elevation data are summarized in Table 2-4 and shown on Figure 2-1.

The groundwater in the vicinity of the site flows in a generally southerly direction towards the Columbia River. Because of the relatively flat gradient at the site, the groundwater flow direction is

expected to vary across the site throughout the year. In addition, because groundwater levels in the aquifer are controlled primarily by the Columbia River, groundwater has been documented to flow away from the river during high-stage events (USEPA, 2013).

2.4 Quality Assurance and Data Validation

Data quality was verified by the collection of field duplicate samples. Field duplicates were collected from two of the sampled wells: RA-MW-15B (QA-1) and RA-MW-12A (QA-2). In addition, a filter blank was collected from an unused field-filter prior to collection of the dissolved samples. The quality control results are presented in Table 2-5. The analytical laboratory quality assurance program (e.g., laboratory duplicates and matrix spike analyses) is discussed in Appendix D. The data are considered acceptable for their intended use, with the appropriate data qualifiers assigned.

2.5 Investigation-Derived Waste

Investigation-derived waste (IDW) generated during the sampling event consisted of well purge/decontamination water, used personal protective equipment (PPE), and disposable sampling supplies. During sampling, approximately 30 gallons of purge/decontamination water was stored on the property in a 55-gallon drum. The drum was labeled with a waste management drum number, the source of the water, the volume of material, and the date of collection.

The purge/decontamination water will be evaluated and disposed of appropriately, based on the analytical results from the groundwater samples, by WasteXpress Environmental. PPE and other solid IDW were disposed of offsite with general refuse.

2.6 Discussion and Conclusions

Detectable concentrations of total chromium were identified in two of the 11 wells sampled during Event 23 on-property well groundwater monitoring. The maximum concentration of 7.48 ug/L (qualified as estimated) was detected in well RA-MW-12A. The concentration of dissolved chromium in RA-MW-12A was 1.13 ug/L.

During the sampling of well RA-MW-12A, groundwater was observed to be relatively turbid throughout the purging process. This relatively high turbidity is thought to be due to the presence of insoluble-chromium-containing particulates suspended in the water column. In Weston's Event 22 report, these particulates were also thought to cause the large discrepancies observed in total chromium concentrations in quality control samples collected from this well (Weston, 2014). Because of the exceedances of acceptable quality control criteria, the total chromium results from well RA-MW-12A were qualified with J, as estimated.

The other well that exhibited a detectable concentration of total chromium was B85-3B (0.130 ug/L). This was slightly above the MRL of 0.1 ug/L.

The samples collected from well RA-MW-12A (primary and duplicate sample QA-2) were also analyzed for total (unfiltered) and dissolved (field-filtered) hexavalent chromium. Neither total nor dissolved hexavalent chromium was detected above the MRL of 5 ug/L.

Sulfate and dissolved sulfur analysis conducted on the RA-MW-12A sample during this event quantified these concentrations as 1,220 mg/L and 11 mg/L, respectively.

DO data collected from the three sampled wells at the ISRM treatment wall, which included RA-MW-12A, RA-MW-12B, and RA-MW-12C, indicates that an area of reducing conditions still exists, and therefore the hexavalent chromium treatment zone still appears to be active. The DO concentrations at these wells ranged from 0.05 mg/L in the shallow well to 0.12 mg/L (RA-MW-12B) and 0.19 mg/L (RA-MW-12C) in the deeper wells. In addition, the negative ORP data collected from these wells, which ranged from -290.9 mV to -47.5 mV, imply that reducing conditions are present within the ISRM treatment wall.

LIMITATIONS

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

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TABLES



Table 2-1
Groundwater Analytical Results
Former Frontier Hard Chrome
Vancouver, Washington

Location	Sample Date	Chromium (ug/L)		Hexavalent Chromium (ug/L)		Sulfur (mg/L)	Sulfate (mg/L)
		Total	Dissolved	Total	Dissolved	Dissolved	Total
B85-3B	06/27/2016	0.130	--	--	--	--	--
RA-MW-12A	06/27/2016	7.48 J	1.13	5 U	5 U	11.0	1,220
RA-MW-12B	06/27/2016	0.1 U	--	--	--	--	--
RA-MW-12C	06/28/2016	0.1 U	--	--	--	--	--
RA-MW-15A	06/27/2016	0.1 U	--	--	--	--	--
RA-MW-15B	06/27/2016	0.1 U	0.1 U	--	--	--	--
RA-MW-16A	06/28/2016	0.1 U	--	--	--	--	--
RA-MW-16B	06/28/2016	0.1 U	--	--	--	--	--
RA-MW-17A	06/28/2016	0.1 U	--	--	--	--	--
W92-16A	06/27/2016	0.1 U	--	--	--	--	--
W92-16B	06/27/2016	0.1 U	--	--	--	--	--

NOTES:

-- = not analyzed.

J = qualified as estimated.

mg/L = milligrams per liter.

U = not detected.

ug/L = micrograms per liter.

Table 2-2
Water Quality Field Parameters
Former Frontier Hard Chrome
Vancouver, Washington

Location	Sample Date	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTU)
B85-3B	06/27/2016	14.62	1.111	0.09	6.42	8.6	1.46
RA-MW-12A	06/27/2016	23.59	2.243	0.05	7.07	-290.9	38.30
RA-MW-12B	06/27/2016	17.19	0.991	0.12	6.87	-47.5	1.00
RA-MW-12C	06/28/2016	14.75	0.864	0.19	7.03	-259.7	1.19
RA-MW-15A	06/27/2016	19.18	0.954	0.18	6.42	11.6	4.78
RA-MW-15B	06/27/2016	16.71	0.615	0.08	6.73	27.1	1.85
RA-MW-16A	06/28/2016	17.90	0.540	0.38	5.52	-45.4	8.07
RA-MW-16B	06/28/2016	15.00	0.612	0.54	6.34	-46.5	0.90
RA-MW-17A	06/28/2016	15.06	0.861	0.59	5.76	-182.3	0.79
W92-16A	06/27/2016	17.11	0.253	0.17	6.67	-12.7	1.36
W92-16B	06/27/2016	20.50	0.170	2.90	6.39	48.1	1.23
NOTES: °C = degrees Celsius. mg/L = milligrams per liter. mS/cm = millisiemens per centimeter. mV = millivolts. NTU = nephelometric turbidity unit. ORP = oxidation reduction potential. pH = potential hydrogen.							

Table 2-3
Water Quality Parameters
Former Frontier Hard Chrome
Vancouver, Washington

Well No.	Temperature (°C)																				
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06	Mar-07	Jun-07	Sep-07	Dec-07	Sep-08	Sep-09	Sep-10	Sep-11	Oct-12	Dec-13	Oct-14	Jun-16
B85-3	14.6	14.8	15.2	15.8	14.4	14.1	13.6	14.6	12.4	12.5	13.6	13.7	13.1	8.0	14.0	13.2	14.0	12.5	11.7	6.6	14.6
B85-4	14.1	14.4	15.1	14.4	13.9	13.5	14.3	14.5	13.8	14.6	14.4	-	13.5	8.7	14.7	17.0	14.9	13.2	12.7	7.7	—
B87-8	14.5	14.7	15.8	15.2	14.7	14.4	14.5	14.4	13.8	14.4	14.3	14.5	13.6	8.8	14.3	13.7	14.6	13.3	12.9	7.6	—
RA-MW-12A	14.9	15.9	17.9	15.2	14.9	14.6	14.3	14.9	13.9	14.0	13.9	14.4	13.8	8.7	15.5	13.5	14.5	14.1	12.7	7.5	23.6
RA-MW-12B	14.4	16.6	16.7	15.6	14.3	14.9	14.4	14.5	13.4	14.3	14.1	14.4	13.3	8.5	14.2	13.7	14.0	13.5	12.3	7.3	17.2
RA-MW-12C	14.4	16.5	16.6	15.1	14.2	14.3	14.2	14.2	13.1	13.3	14.1	14.1	13.2	8.5	14.4	13.2	14.5	13.2	12.6	7.4	14.8
RA-MW-15A	14.3	14.5	15.0	15.0	14.7	14.8	14.7	15.1	14.7	15.3	15.1	14.7	13.6	9.0	14.6	14.1	14.3	13.1	13.0	7.5	19.2
RA-MW-15B	13.9	14.4	15.4	14.7	14.1	14.0	14.5	17.2	14.1	14.8	14.9	14.3	13.4	8.8	14.6	14.0	14.3	13.2	12.9	7.5	16.7
RA-MW-16A	14.3	14.9	16.0	14.9	15.1	13.3	13.4	14.8	13.8	14.0	13.9	14.1	—	8.6	14.2	13.8	14.2	13.3	13.3	7.3	17.9
RA-MW-16B	14.3	14.6	16.0	14.7	13.9	13.7	13.8	15.2	13.4	14.3	13.8	14.1	—	8.8	14.4	14.0	14.1	13.4	13.0	7.6	15.0
RA-MW-17A	14.3	15.3	16.7	15.1	14.5	13.7	—	13.9	13.4	13.1	14.1	13.8	13.4	8.5	13.7	13.8	13.8	13.0	13.1	7.2	15.1
W85-6A	14.1	14.1	15.5	14.0	—	—	13.7	15.3	13.9	13.2	13.6	14.1	13.2	8.7	15.7	14.4	15.2	14.3	14.8	8.3	—
W85-6B	13.6	13.8	16.3	13.7	—	—	13.8	15.1	13.1	13.1	13.8	15.0	12.9	8.6	16.6	14.5	15.0	14.2	12.6	8.2	—
W92-16A	14.2	15.6	16.1	15.3	14.0	13.8	14.1	15.5	13.6	13.3	14.5	14.5	13.3	8.6	14.8	14.3	15.1	13.9	12.9	7.4	17.1
W92-16B	14.1	14.7	16.2	15.2	13.7	13.7	13.8	15.4	13.1	13.3	14.4	14.6	13.0	8.7	14.6	14.0	15.0	13.4	11.7	7.4	20.5
W97-18A	11.3	11.0	15.0	12.7	13.9	12.0	—	13.8	13.0	11.6	12.5	13.2	13.0	7.8	13.7	13.6	14.5	13.8	13.7	8.2	—
W97-19A	12.5	13.3	16.0	14.3	13.8	12.9	—	15.3	13.9	13.8	14.1	14.3	13.3	8.7	14.9	14.3	14.9	14.1	13.1	7.9	—
W97-19B	12.7	13.3	15.9	15.3	13.3	12.4	—	15.2	13.0	14.2	14.4	14.5	12.9	8.8	14.1	14.2	15.0	14.0	12.4	7.5	—
W98-21A	13.1	14.3	14.2	13.8	13.9	13.8	13.7	15.0	13.7	13.7	14.0	14.5	12.3	8.4	17.1	14.1	14.5	14.1	14.1	8.1	—
W98-21B	13.1	13.6	14.0	13.8	13.7	13.0	13.7	14.7	13.4	13.5	14.2	14.5	13.2	8.5	16.7	13.8	14.7	13.7	13.5	7.9	—
W99-R5A	14.2	14.9	15.7	14.8	14.8	14.7	15.1	—	13.9	13.9	15.5	15.4	14.1	10.0	14.7	14.3	14.8	14.1	12.7	7.9	—
W99-R5B	13.9	14.4	15.6	14.4	14.5	13.9	14.7	—	13.5	13.5	15.0	15.2	13.6	9.5	15.1	14.2	14.4	13.9	13.2	8.0	—

NOTES:
— = not measured.
°C = degrees Celsius.
mg/L = milligrams per liter.
mS/cm = millisiemens per centimeter.
mV = millivolts.

Table 2-3
Water Quality Parameters
Former Frontier Hard Chrome
Vancouver, Washington

Well No.	Conductivity (mS/cm)																				
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06	Mar-07	Jun-07	Sep-07	Dec-07	Sep-08	Sep-09	Sep-10	Sep-11	Oct-12	Dec-13	Oct-14	Jun-16
B85-3	0.99	0.90	0.98	0.81	0.54	0.74	0.64	0.72	0.97	0.84	0.68	0.77	0.90	0.81	0.77	0.72	0.65	0.88	0.88	1.02	1.11
B85-4	0.41	1.17	0.51	0.71	0.28	0.74	0.33	0.56	0.92	739.00	0.60	-	0.43	0.63	0.58	0.55	0.34	0.42	0.52	0.57	—
B87-8	0.26	0.55	0.36	0.29	0.24	0.38	0.27	0.36	0.44	0.39	0.19	0.33	0.36	0.27	0.32	0.45	0.31	0.39	0.22	0.28	—
RA-MW-12A	6.01	5.40	4.00	3.32	2.52	2.47	2.37	2.26	2.95	0.85	1.11	1.98	2.34	2.55	2.92	2.59	2.55	2.27	1.93	2.07	2.24
RA-MW-12B	2.25	1.19	1.52	2.56	2.47	1.34	1.39	1.19	2.12	1.12	0.89	1.55	1.49	1.55	1.74	1.11	0.78	0.86	0.81	0.92	0.99
RA-MW-12C	2.18	1.34	1.13	0.68	1.09	0.69	0.88	0.53	1.05	0.65	0.49	0.58	0.81	0.80	0.97	0.72	0.54	0.56	0.61	0.86	0.86
RA-MW-15A	1.88	1.04	1.08	1.30	1.42	1.53	1.44	1.27	1.74	1.10	1.06	1.06	1.28	1.03	1.04	0.99	0.89	1.11	1.16	1.19	0.95
RA-MW-15B	0.47	0.86	0.68	0.64	0.91	0.92	0.80	0.46	1.60	1.16	0.49	0.81	1.22	0.93	0.85	0.49	0.33	0.39	0.66	0.67	0.62
RA-MW-16A	2.95	1.46	2.00	1.70	1.07	1.04	1.01	0.80	1.13	1.02	0.83	0.91	—	0.93	1.04	0.89	0.83	0.92	0.76	0.89	0.54
RA-MW-16B	2.42	1.19	1.40	1.81	0.92	0.67	0.51	0.43	1.34	1.05	0.32	0.48	—	0.74	0.66	0.49	0.50	0.78	0.71	0.89	0.61
RA-MW-17A	1.80	1.80	1.80	1.39	1.18	1.30	—	1.18	1.30	1.04	1.03	1.16	1.47	1.46	1.43	1.23	0.96	1.05	0.95	1.09	0.86
W85-6A	0.11	0.33	0.34	299.00	—	—	0.23	0.24	0.24	0.36	0.27	0.32	0.30	0.27	0.24	0.26	0.22	0.25	0.25	0.33	—
W85-6B	0.31	0.41	0.33	0.26	—	—	0.10	0.11	0.17	0.24	0.19	0.20	0.26	0.32	0.22	0.19	0.18	0.22	0.21	0.30	—
W92-16A	0.33	0.25	0.27	0.23	0.24	0.28	0.28	0.37	0.47	0.57	0.47	0.53	0.64	0.61	0.48	0.36	0.36	0.34	0.26	0.31	0.25
W92-16B	1.17	1.37	0.95	0.66	0.09	0.34	0.42	0.32	0.61	0.57	0.25	0.44	0.60	0.50	0.15	0.21	0.27	0.27	0.09	0.20	0.17
W97-18A	0.11	0.09	0.11	0.08	0.10	0.19	—	0.15	0.16	0.16	0.10	0.14	0.18	0.23	0.21	0.19	0.16	0.17	0.18	0.30	—
W97-19A	0.25	0.26	0.28	0.23	0.23	0.19	—	0.21	0.26	0.24	0.19	0.22	0.26	0.30	0.30	0.26	0.24	0.25	0.24	0.32	—
W97-19B	0.26	0.26	0.29	0.22	0.06	0.19	—	0.20	0.28	0.23	0.19	0.21	0.25	0.30	0.09	0.26	0.24	0.26	0.20	0.24	—
W98-21A	0.16	0.23	0.29	0.45	0.19	0.19	0.22	0.25	0.29	0.29	0.27	0.27	0.09	0.29	0.30	0.28	0.22	0.25	0.25	0.32	—
W98-21B	0.24	0.27	0.27	0.25	0.18	0.22	0.21	0.24	0.32	0.31	0.21	0.26	0.27	0.29	0.26	0.30	0.20	0.27	0.23	0.21	—
W99-R5A	0.24	0.25	0.24	0.22	0.21	0.20	0.20	—	0.27	0.22	0.21	0.21	0.20	0.27	0.28	0.26	0.22	0.25	0.24	0.31	—
W99-R5B	0.26	0.26	0.27	0.23	0.22	0.22	0.22	—	0.28	0.24	0.21	0.22	0.26	0.29	0.27	0.25	0.23	0.25	0.24	0.31	—

NOTES:
— = not measured.
°C = degrees Celsius.
mg/L = milligrams per liter.
mS/cm = millisiemens per centimeter.
mV = millivolts.

Table 2-3
Water Quality Parameters
Former Frontier Hard Chrome
Vancouver, Washington

Well No.	Dissolved Oxygen (mg/L)																				
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06	Mar-07	Jun-07	Sep-07	Dec-07	Sep-08	Sep-09	Sep-10	Sep-11	Oct-12	Dec-13	Oct-14	Jun-16
B85-3	1.11	0.16	1.57	4.50	0.12	2.97	0.22	1.04	0.80	0.02	0.24	0.15	0.21	0.18	0.39	0.27	0.62	0.28	0.42	0.21	0.09
B85-4	0.65	1.37	1.50	0.33	0.20	0.22	0.52	1.61	0.30	0.03	0.27	-	0.24	0.26	0.40	0.34	0.55	0.38	0.34	0.66	—
B87-8	0.13	1.03	1.06	0.35	0.28	0.53	0.37	0.52	0.25	0.01	7.00	0.19	0.11	0.24	0.40	0.17	0.62	0.42	0.21	0.66	—
RA-MW-12A	0.24	0.09	0.20	0.13	0.04	0.00	52.70	17.00	56.41	0.00	0.00	-0.47	0.00	0.00	0.51	1.96	1.28	2.88	1.58	0.18	0.05
RA-MW-12B	0.27	0.07	0.27	0.07	0.05	1.26	45.10	12.16	73.22	0.00	9.82	-0.39	0.00	0.00	0.40	0.23	0.27	0.20	0.71	0.65	0.12
RA-MW-12C	0.20	0.14	0.42	0.25	0.07	1.10	5.16	4.93	3.33	0.01	0.40	0.23	0.00	0.28	0.53	0.20	0.18	0.49	0.97	0.43	0.19
RA-MW-15A	0.33	0.21	1.53	0.47	0.15	8.34	0.47	2.89	0.29	0.04	0.19	0.48	0.10	0.32	0.48	0.32	0.56	0.42	2.59	0.19	0.18
RA-MW-15B	0.22	0.10	0.74	0.44	0.18	0.79	0.30	1.25	0.30	0.06	0.15	0.18	0.12	0.30	0.60	0.26	0.54	0.19	1.66	0.26	0.08
RA-MW-16A	0.73	0.27	1.39	1.60	0.11	5.40	0.54	0.49	0.31	0.05	0.36	0.31	—	0.15	0.43	0.31	0.65	0.43	2.65	0.53	0.38
RA-MW-16B	0.75	0.15	0.86	0.75	0.33	1.85	0.27	0.27	0.21	0.05	0.24	0.16	—	0.19	0.33	0.25	0.36	0.17	1.77	0.85	0.54
RA-MW-17A	0.60	0.19	1.99	0.60	0.20	3.69	—	0.74	0.35	0.11	0.14	0.22	0.10	0.19	0.51	0.32	0.45	0.37	2.33	0.54	0.59
W85-6A	4.92	0.43	0.85	4.90	—	—	1.86	2.06	2.63	0.09	0.51	0.93	2.52	2.08	4.01	2.97	3.51	5.07	1.95	2.30	—
W85-6B	3.46	6.13	6.54	5.50	—	—	7.87	3.83	5.15	0.05	4.96	5.95	6.10	4.87	13.98	10.48	9.20	10.86	8.75	9.17	—
W92-16A	0.98	0.13	2.49	3.10	0.28	0.15	0.45	0.32	0.33	0.13	0.32	0.22	0.11	0.15	0.54	0.28	0.48	0.24	1.51	0.28	0.17
W92-16B	0.14	0.53	1.97	3.40	5.40	1.02	0.54	2.12	0.23	0.80	4.16	1.60	0.11	1.31	14.02	10.90	8.21	9.27	8.30	6.48	2.90
W97-18A	1.27	0.74	1.09	0.50	1.10	4.00	—	1.45	0.90	0.90	0.67	0.69	0.69	0.64	0.33	0.19	0.66	1.00	0.30	0.26	—
W97-19A	4.72	1.79	22.73	4.60	0.97	3.51	—	3.50	9.37	1.00	3.74	3.57	4.69	3.92	6.56	2.42	3.67	2.85	5.31	3.96	—
W97-19B	1.81	1.31	2.60	2.60	1.10	2.99	—	3.43	4.13	0.52	2.83	3.55	3.44	3.01	9.81	1.67	4.06	2.80	0.16	0.44	—
W98-21A	1.29	1.49	3.03	13.30	1.20	1.05	3.26	2.59	4.97	0.07	0.80	2.44	2.53	2.58	3.18	2.81	3.52	4.53	2.65	3.14	—
W98-21B	1.24	3.29	2.82	17.70	3.90	1.08	3.37	2.42	4.90	0.02	3.52	1.98	2.73	2.58	8.21	2.60	7.13	4.92	4.70	5.46	—
W99-R5A	4.72	4.26	5.60	5.30	3.30	1.83	5.10	—	6.26	4.90	4.53	4.55	5.38	5.40	6.33	5.10	5.13	4.38	5.80	5.68	—
W99-R5B	3.97	2.71	4.70	5.10	1.90	2.03	4.20	—	4.90	3.40	3.49	3.86	4.66	4.34	5.76	5.03	4.55	4.86	4.79	4.23	—

NOTES:
— = not measured.
°C = degrees Celsius.
mg/L = milligrams per liter.
mS/cm = millisiemens per centimeter.
mV = millivolts.

Table 2-3
Water Quality Parameters
Former Frontier Hard Chrome
Vancouver, Washington

Well No.	Potential Hydrogen																				
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06	Mar-07	Jun-07	Sep-07	Dec-07	Sep-08	Sep-09	Sep-10	Sep-11	Oct-12	Dec-13	Oct-14	Jun-16
B85-3	6.49	6.68	6.91	6.39	6.70	6.64	6.42	6.33	6.73	6.68	6.66	6.88	7.02	6.88	6.74	6.85	5.82	6.82	6.92	6.79	6.42
B85-4	6.14	6.26	6.53	6.22	6.51	6.49	6.21	6.28	6.47	6.53	6.53	—	7.21	6.62	6.28	6.41	5.20	6.77	6.73	6.61	—
B87-8	6.55	6.31	6.73	6.54	6.68	6.57	6.35	6.61	6.71	6.71	6.89	6.99	7.44	6.90	6.90	6.63	6.14	6.79	6.91	6.79	—
RA-MW-12A	8.86	8.73	8.86	8.98	8.41	8.19	8.46	8.54	7.59	7.86	7.97	7.97	8.53	7.16	7.64	7.79	6.58	7.50	7.47	7.66	7.07
RA-MW-12B	7.77	7.83	7.92	8.30	8.68	8.16	7.76	7.83	8.06	7.94	7.55	7.79	8.28	7.75	7.25	7.31	6.43	7.40	7.41	7.63	6.87
RA-MW-12C	8.13	7.92	8.09	7.95	8.14	7.89	7.92	7.90	7.74	7.80	7.79	8.14	8.57	7.99	7.81	7.70	6.68	7.78	7.89	7.79	7.03
RA-MW-15A	6.35	6.37	6.74	6.20	6.30	6.47	6.28	6.09	6.53	6.61	6.50	6.68	7.19	6.63	6.53	6.51	5.80	6.53	6.55	6.52	6.42
RA-MW-15B	6.35	6.83	7.18	6.39	6.39	6.51	6.26	6.61	6.39	6.48	6.84	6.73	7.18	6.66	6.52	7.01	6.33	7.23	6.73	6.79	6.73
RA-MW-16A	6.61	6.61	6.75	6.42	6.44	6.62	6.44	5.96	6.68	6.71	6.64	6.82	—	6.74	6.62	6.56	4.35	6.54	6.57	6.45	5.52
RA-MW-16B	6.42	7.12	7.09	6.31	7.12	7.06	6.85	6.09	6.62	6.78	7.27	7.41	—	7.11	7.18	7.28	5.43	6.83	6.83	6.74	6.34
RA-MW-17A	6.55	6.43	6.61	6.20	6.39	6.50	—	6.42	6.66	6.59	6.47	6.69	7.26	6.65	6.68	6.55	5.57	6.52	6.61	6.56	5.76
W85-6A	6.23	6.22	6.40	6.36	—	—	6.25	5.47	6.63	6.47	6.50	6.77	6.85	6.71	6.24	6.52	6.07	6.54	6.65	6.46	—
W85-6B	6.40	6.42	6.68	6.62	—	—	8.93	7.16	8.05	6.83	6.76	7.15	7.09	6.87	8.50	9.12	7.80	7.65	8.63	7.41	—
W92-16A	6.42	6.42	6.72	6.60	6.56	6.60	6.67	5.87	6.59	6.52	6.44	6.75	7.41	6.61	6.40	6.56	5.47	6.60	6.81	6.65	6.67
W92-16B	7.51	7.58	7.63	7.59	6.88	7.54	7.38	6.35	7.46	7.62	7.51	7.70	8.23	7.21	7.22	7.17	5.93	6.93	6.61	6.72	6.39
W97-18A	5.83	5.96	6.19	6.17	6.78	6.57	—	5.08	6.29	6.32	6.23	6.54	7.07	6.33	6.33	6.30	5.20	6.25	6.46	6.31	—
W97-19A	6.35	6.24	6.28	6.35	6.59	6.41	—	5.53	6.55	6.58	6.57	6.91	7.33	6.51	6.35	6.53	3.30	6.55	6.77	6.19	—
W97-19B	6.68	6.49	6.30	6.47	6.68	6.68	—	5.89	6.83	6.76	6.72	6.95	7.50	6.65	7.14	6.78	4.94	6.70	6.86	6.81	—
W98-21A	5.92	6.07	6.68	6.18	6.30	6.25	6.11	4.80	6.16	6.43	6.34	6.53	6.81	6.48	6.07	6.25	5.62	6.34	6.45	6.28	—
W98-21B	6.04	6.07	6.90	6.24	6.64	6.36	6.07	5.55	6.38	6.39	6.46	6.48	7.08	6.44	6.19	6.38	5.34	6.49	6.54	6.31	—
W99-R5A	6.03	5.98	6.28	6.21	6.22	6.28	6.23	—	6.40	6.30	6.18	6.58	6.73	6.31	6.52	6.35	5.60	6.40	6.38	6.16	—
W99-R5B	6.20	6.23	6.55	6.33	6.63	6.55	6.26	—	6.62	6.63	6.54	6.90	6.92	6.54	6.66	6.67	5.95	6.64	6.73	6.51	—

NOTES:
— = not measured.
°C = degrees Celsius.
mg/L = milligrams per liter.
mS/cm = millisiemens per centimeter.
mV = millivolts.

Table 2-3
Water Quality Parameters
Former Frontier Hard Chrome
Vancouver, Washington

Well No.	Oxidation Reduction Potential (mV)																			
	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06	Mar-07	Jun-07	Sep-07	Dec-07	Sep-08	Sep-09	Sep-10	Sep-11	Oct-12	Dec-13	Oct-14	Jun-16
B85-3	-107	-37	-47	-93	-62	-43	-53	-59	-43	-66	-30	-52	-39	27	-61	-50	-58	-48	-61	9
B85-4	41	59	218	-26	75	86	179	161	182	90	-	123	108	162	220	479	119	19	96	—
B87-8	31	17	199	2	73	86	160	167	170	87	95	106	96	107	12	42	-17	14	-2	—
RA-MW-12A	-466	-430	-417	-403	-393	-363	-311	-373	-324	-374	-369	-396	-310	-154	-304	-333	-278	-295	-320	-291
RA-MW-12B	-321	-315	-415	-414	-345	-327	-355	-374	-313	-363	-361	-379	-318	-215	-283	-308	-214	-264	-231	-48
RA-MW-12C	-179	-154	-239	-314	-234	-191	-164	-217	-137	-129	-235	-289	-219	-167	-233	-275	-178	-253	-294	-260
RA-MW-15A	4	39	10	-12	-137	-28	-52	-24	13	-58	41	7	47	93	50	68	3	-41	49	12
RA-MW-15B	28	15	17	-11	16	34	76	32	48	-15	64	29	82	122	75	407	67	-37	82	27
RA-MW-16A	-45	-58	-156	-103	-160	-93	-125	-125	-112	-109	-21	—	-30	120	96	315	67	-30	16	-45
RA-MW-16B	-70	-60	-85	-130	-131	-66	-155	-113	-88	-112	-43	—	-46	29	21	490	110	-30	-52	-47
RA-MW-17A	-40	-7	-5	-27	-89	—	-106	-34	-128	-79	74	-25	-11	-6	-39	54	-35	-41	-30	-182
W85-6A	57	86	163	—	—	107	356	123	172	168	240	176	218	200	144	328	102	27	102	—
W85-6B	76	72	159	—	—	79	340	70	164	161	236	177	229	165	117	357	107	24	101	—
W92-16A	-14	30	110	110	-32	61	129	127	76	100	98	112	113	154	118	413	111	-164	88	-13
W92-16B	-61	-60	73	119	-103	30	253	113	71	60	116	114	121	152	151	459	134	-96	97	48
W97-18A	57	67	103	58	137	—	317	192	119	135	133	130	147	60	140	505	150	20	98	—
W97-19A	94	72	218	69	149	—	311	96	71	156	233	128	205	127	155	609	112	30	144	—
W97-19B	86	56	52	76	142	—	295	88	74	153	240	121	193	138	163	562	126	25	-46	—
W98-21A	69	79	182	113	160	114	484	157	-55	165	243	135	228	183	196	453	155	21	105	—
W98-21B	72	47	202	121	161	117	471	148	111	161	249	140	226	188	194	486	156	26	106	—
W99-R5A	96	97	153	123	197	116	—	131	100	81	237	186	226	134	174	403	140	44	114	—
W99-R5B	78	74	201	92	204	111	—	122	92	90	239	180	213	167	162	414	141	34	104	—

NOTES:

— = not measured.

°C = degrees Celsius.

mg/L = milligrams per liter.

mS/cm = millisiemens per centimeter.

mV = millivolts.

Table 2-3
Water Quality Parameters
Former Frontier Hard Chrome
Vancouver, Washington

Well No.	Dissolved Sulfur (mg/L)																				
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06	Mar-07	Jun-07	Sep-07	Dec-07	Sep-08	Sep-09	Sep-10	Sep-11	Oct-12	Dec-13	Oct-14	Jun-16
B85-3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
B85-4	23	150	31	87	20	103	21	59	67	59	75	-	23	39	32	33	13	20	32	25	—
B87-8	9	52	22	17	23	48	21	42	31	34	43	28	24	14	17	35	12	22	10	9	—
RA-MW-12A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	380	11
RA-MW-12B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RA-MW-12C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RA-MW-15A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RA-MW-15B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RA-MW-16A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RA-MW-16B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RA-MW-17A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W85-6A	—	15	14	18	—	—	12	15	7	26	19	19	10	9	6	7	7	8	5	5	—
W85-6B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W92-16A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W92-16B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W97-18A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W97-19A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W97-19B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W98-21A	—	—	—	—	8	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W98-21B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W99-R5A	5	6	4	5	6	7	6	5	5	5	5	5	6	6	6	5	5	5	5	5	—
W99-R5B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTES:
— = not measured.
°C = degrees Celsius.
mg/L = milligrams per liter.
mS/cm = millisiemens per centimeter.
mV = millivolts.

Table 2-3
Water Quality Parameters
Former Frontier Hard Chrome
Vancouver, Washington

Well No.	Sulfate (mg/L)																				
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06	Mar-07	Jun-07	Sep-07	Dec-07	Sep-08	Sep-09	Sep-10	Sep-11	Oct-12	Dec-13	Oct-14	Jun-16
B85-3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
B85-4	58	410	104	222	50	253	75	169	212	201	195	-	60	107	95	97	38	55	88	69	—
B87-8	21	137	73	170	63	125	74	117	98	113	120	87	61	39	54	102	35	63	28	25	—
RA-MW-12A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	973	1220
RA-MW-12B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RA-MW-12C	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RA-MW-15A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RA-MW-15B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RA-MW-16A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RA-MW-16B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RA-MW-17A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W85-6A	5	36	44	44	—	—	35	41	21	85	51	59	27	20	19	20	22	22	14	13	—
W85-6B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W92-16A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W92-16B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W97-18A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W97-19A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W97-19B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W98-21A	—	—	—	—	19	25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W98-21B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W99-R5A	12	12	13	15	13	15	18	14	14	16	14	15	16	17	19	15	16	15	13	14	—
W99-R5B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTES:
— = not measured.
°C = degrees Celsius.
mg/L = milligrams per liter.
mS/cm = millisiemens per centimeter.
mV = millivolts.

Table 2-4
Water Level Elevations—June 2016
Former Frontier Hard Chrome
Vancouver, Washington

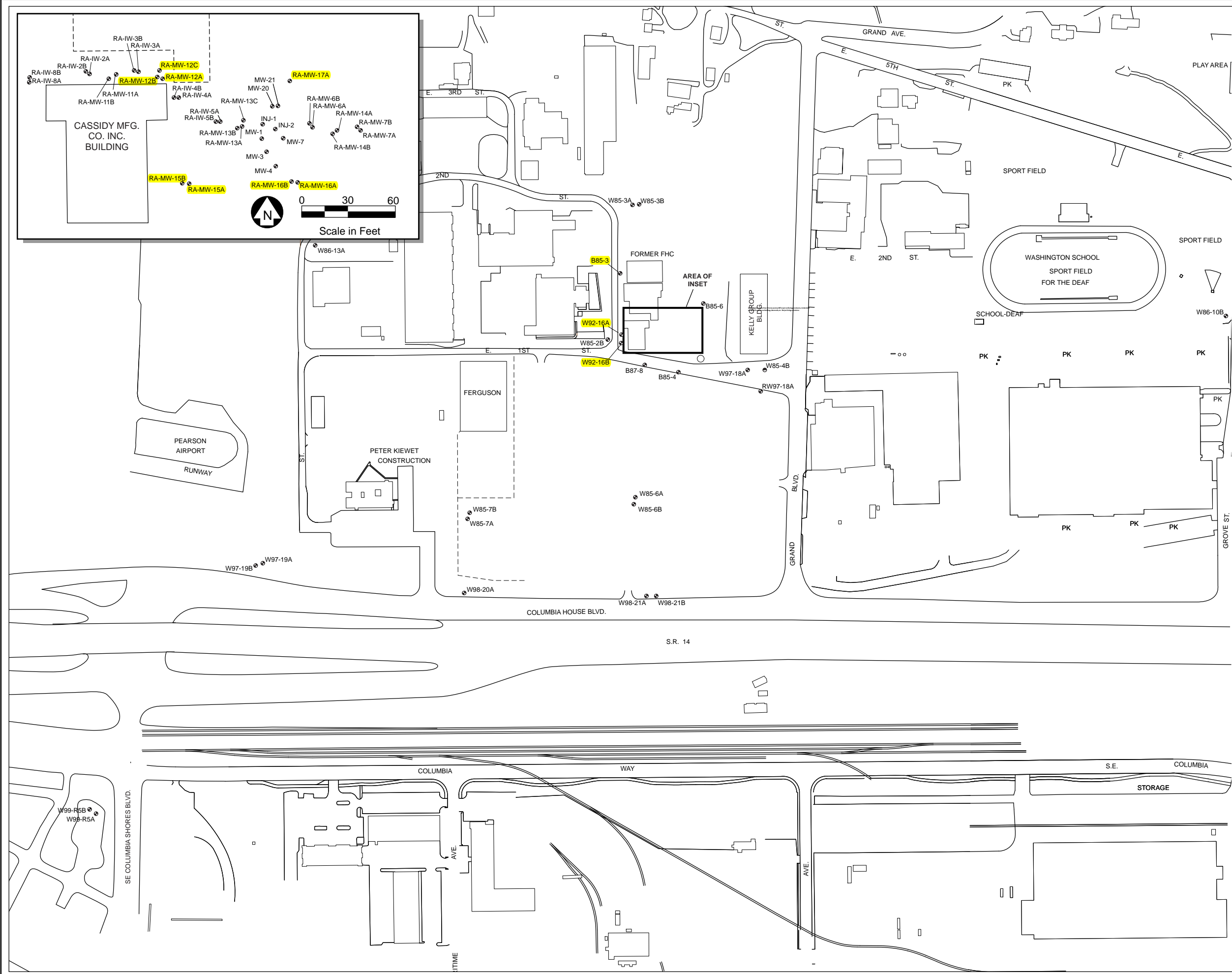
Well Number	Date	Time (24-hour)	Casing Elevation* (feet AMSL)	DTW (feet)	Water Level Elevation (feet AMSL)
B85-3	06/27/2016	6:40	26.77	18.11	8.66
RA-MW-12A	06/27/2016	15:00	26.17	15.35	10.82
RA-MW-12B	06/27/2016	13:40	26.16	19.42	6.74
RA-MW-12C	06/28/2016	6:45	26.01	19.31	6.70
RA-MW-15A	06/27/2016	12:15	25.76	19.01	6.75
RA-MW-15B	06/27/2016	11:20	25.79	19.05	6.74
RA-MW-16A	06/28/2016	9:35	25.14	18.40	6.74
RA-MW-16B	06/28/2016	8:32	25.45	18.72	6.73
RA-MW-17A	06/28/2016	7:37	25.96	19.19	6.77
W92-16A	06/27/2016	8:03	25.62	18.86	6.76
W92-16B	06/27/2016	9:20	25.51	18.75	6.76
NOTES: AMSL = above mean sea level. DTW = depth to water. *Casing elevation surveyed by Minister-Glaser Surveying, Inc. on November 30, 2007.					

Table 2-5
Quality Assurance Analytical Results
Former Frontier Hard Chrome
Vancouver, Washington

Well Number	Duplicate Sample Identification	Sample Date	Chromium (ug/L)				Hexavalent Chromium (ug/L)				Dissolved Sulfur (mg/L)		Sulfate (mg/L)	
			Field Sample		Duplicate Sample		Field Sample		Duplicate Sample		Field Sample	Duplicate Sample	Field Sample	Duplicate Sample
			Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved				
FILTER BLANK	--	06/27/2016	--	0.1 U	--	--	--	5 UJ	--	--	0.1 U	--	--	--
RA-MW-15B	QA-1	06/27/2016	0.1 U	0.1 U	0.1 U	0.1 U	--	--	--	--	--	--	--	--
RA-MW-12A	QA-2	06/27/2016	7.48 J	1.13	14.8 J	1.07	5 U	5 U	5 UJ	5 UJ	11.0	13.3	1220	1160
NOTES: -- = not analyzed. J = qualified as estimated. mg/L = milligrams per liter. U = not detected. ug/L = micrograms per liter.														

FIGURES





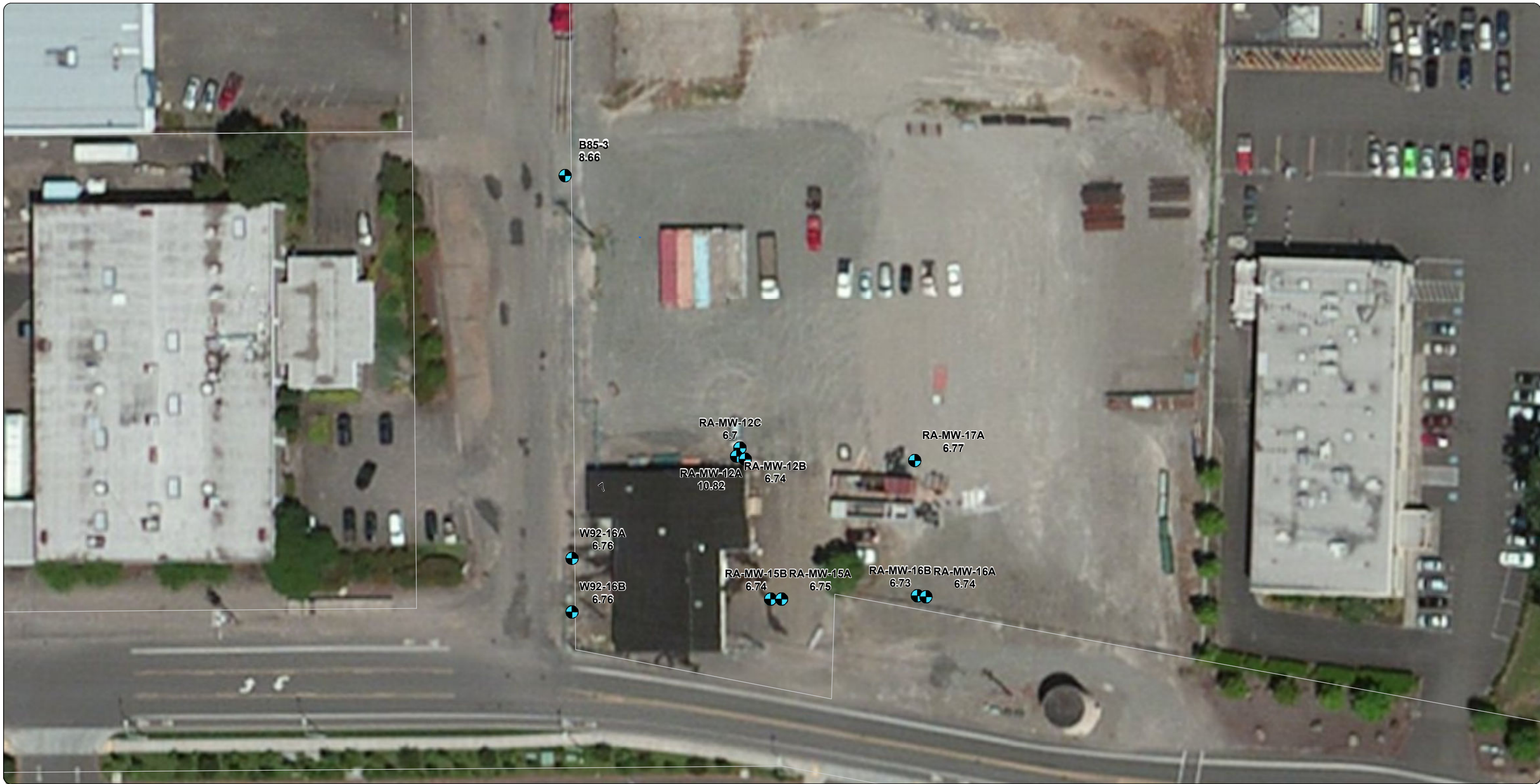
LEGEND

- W85-5B Monitoring Well Location and ID
- W85-4B Abandoned Well Location and ID
- Fence
- Yellow shading indicates monitoring well sampled during June 2016 sampling event.

*Figure base provided by Weston Solutions.

0 150 300
Scale in Feet

Figure 1-1
Monitoring Well Locations
Former Frontier Hard Chrome
Vancouver, Washington



Source: Aerial photograph obtained from Esri ArcGIS Online

Legend

-  Monitoring Wells
-  Tax Lots

Figure 2-1
Groundwater Elevation Data - June 2016
Former Frontier Hard Chrome
Vancouver, Washington

APPENDIX A

SAMPLE PLAN ALTERATION FORM



SAMPLE PLAN ALTERATION FORM FORMER FRONTIER HARD CHROME SITE

June 20, 2016

Long-Term Monitoring Plan: The February 2004 Former Frontier Hard Chrome Site Post Remedial Action Long-Term Monitoring Plan¹ (the plan), prepared by Weston Solutions, Inc., for the U.S. Environmental Protection Agency (USEPA) Region 10, 1200 Sixth Avenue, Seattle, Washington 98101.

Project Name and Number: Former Frontier Hard Chrome Site, USEPA Identification Number WAD053614988. Maul Foster & Alongi, Inc. (MFA) project number 1162.01.03. JH Kelly—Groundwater Sampling and Reporting, Y Street Development, 113 Y Street, Vancouver, Washington 98661 (the site).

Material to Be Sampled:

Groundwater will be sampled from monitoring wells. In preparation for site redevelopment, 11 monitoring wells will be sampled one final time before the monitoring wells are decommissioned. Sampling is scheduled to take place immediately upon agency approval, and decommissioning is anticipated to take place in September 2016.

Measurement Parameters:

Selected shallow and deep-zone monitoring wells to be sampled and laboratory analyses to be conducted are listed below.

Monitoring Wells and Laboratory Analysis		Reporting Limits	
B85-3, RA-MW-15A, RA-MW-16A, RA-MW-17A, W92-16A, RA-MW-12B, RA-MW-12C, RA-MW-16B, W92-16B	Total chromium	Total chromium	2.5 micrograms per liter (ug/L)
		Dissolved chromium	5.0 ug/L
		Total hexavalent chromium	5.0 ug/L
RA-MW-12A	Total and dissolved chromium; total and dissolved hexavalent chromium; dissolved sulfur; sulfate	Dissolved hexavalent chromium	5.0 ug/L
		Dissolved sulfur	1.0 milligrams per liter (mg/L)
RA-MW-15B	Total and dissolved chromium	Sulfate	0.5 mg/L

Standard Procedure for Field Collection and Laboratory Analysis (cite references):

Procedures for collecting groundwater samples are outlined in the plan. MFA will generally follow these procedures, except where noted in this sample plan alteration form.

Laboratory analyses will include the following:

- Total and dissolved chromium by USEPA Method 6010C
- Total and dissolved hexavalent chromium by USEPA 7196
- Dissolved sulfur by USEPA Method 6010C
- Total sulfate by USEPA Method 300.0

¹ Weston. 2004. Frontier Hard Chrome Post Remedial Action Long-Term Monitoring Plan. Prepared for U.S. Environmental Protection Agency Region 10. Weston Solutions, Inc., Seattle, Washington.

SAMPLE PLAN ALTERATION FORM FORMER FRONTIER HARD CHROME SITE

Additional references:

- USEPA. 2014. Contract laboratory program, national functional guidelines for inorganic Superfund data review. EPA 540/R-013/001. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation. August.
- USEPA. 2014. Contract laboratory program guidance for field samplers. 200.2-147, USEPA-540-R-014-013. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. October.

Reason for Change in Field Procedure or Analytical Variation:

The site owner intends to develop the site. The USEPA requires that groundwater sampling be conducted in 11 monitoring wells on the site. The site owner has contracted MFA to conduct the groundwater sampling in order to expedite the fieldwork. MFA has reviewed the plan. This sample plan alteration form has been prepared to discuss the variations set forth by the USEPA and the Washington State Department of Ecology (Ecology) to perform groundwater sampling and analysis per the aforementioned measurement parameters. This sample plan alteration form also outlines sampling methods and procedures that MFA will use that differ from those specified in the plan. In general, MFA will follow the methods and procedures specified in the plan for conducting fieldwork, quality assurance and quality control, and reporting.

Variation from Field or Analytical Procedure:

The following variations and changes to procedures will be used in addition to, or in lieu of, procedures identified in the plan:

Groundwater samples will be analyzed by an Ecology-accredited laboratory, Specialty Analytical, Inc., of Clackamas, Oregon. Sample information will be recorded on a chain-of-custody form provided by the laboratory. A copy of the chain-of-custody form is attached.

USEPA directed the analysis listed above and no deviations will occur regardless of a final turbidity reading greater than 10 nephelometric turbidity units.

Dissolved chromium, dissolved hexavalent chromium, and dissolved sulfur samples will be field-filtered with a 0.45-micron filter. One filter blank water sample will be collected and analyzed for dissolved chromium, dissolved hexavalent chromium, and dissolved sulfur.

Samples will not be analyzed for hexavalent chromium in the field because we are using laboratory methods to analyze hexavalent chromium. Hexavalent chromium water samples will be analyzed by the laboratory within 24 hours of sample collection.

Sample containers will be supplied by the laboratory with necessary preservatives, and therefore samples will not be checked for potential hydrogen (pH) in the field to determine if acids should be added to samples. However, prior to sampling, pH will be measured on the purge water when collecting groundwater water-quality field parameters with the YSI.

MFA will use field sampling data sheets (FSDSs) (a sample FSDS is attached) to record sampling and purging data. Groundwater elevation data will be recorded on an FSDS for each of the wells to be sampled.

Contact information on the label for investigation-derived waste will read "Contact Mark Fleischauer, JH Kelly, at

SAMPLE PLAN ALTERATION FORM FORMER FRONTIER HARD CHROME SITE

(360) 423-5510, for information.” Investigation-derived waste will be disposed of consistent with Washington State and federal regulations (depending on laboratory analysis) by WasteXpress of Seattle, Washington.

Collection of an ambient blank is not required because analysis for volatile organic compounds will not be conducted.

Laboratory-provided data deliverables will include the following: transmittal cover letter, case narrative, analytical results, chain-of-custody, surrogate recoveries, method-blank results, matrix spike/matrix-spike duplicate results, and laboratory duplicate results. The laboratory will perform matrix spike/matrix-spike duplicate analysis on total chromium, total hexavalent chromium, dissolved chromium, and dissolved hexavalent chromium.

Data validations will be performed consistent with the technical specifications of the analytical methods and the USEPA contract laboratory program, national functional guidelines for inorganic Superfund data review (see the reference in the Standard Procedure for Field Collection and Laboratory Analysis section).

Additional qualifiers to the plan include J+ (estimated result quantity, but the result may be biased high), and J- (estimated result quantity, but the result may be biased low).

The wells will not be screened with a photoionization detector before sampling because of the contaminants of interest for this sampling event.

Two field replicate (duplicate) samples will be collected during this sampling event to be consistent with the number of field replicates collected per number of wells sampled in previous sampling events.

Special Equipment, Materials, or Personnel Required:





Project Contact List and Monitoring Plan Distribution List:

Name	Title	Organization	Telephone / e-mail Address
Bill Ryan	USEPA Project Manager	USEPA, Seattle, Washington	Phone: (206) 553-8561 and e-mail: ryan.william@epa.gov
Panjini Balaraju	Ecology Project Manager	Ecology, Olympia, Washington	Phone: (360) 407-6335 and e-mail: panjini.balaraju@ecy.wa.gov
Andrew Vidourek	MFA Project Manager/ Field Leader	MFA, Vancouver, Washington	Phone: (360) 433-0248 and e-mail: avidourek@maulfoster.com
Tony Silva	MFA Senior Geologist/ Quality Assurance Officer	MFA, Vancouver, Washington	Phone: (360) 433-0245 and e-mail: tsilva@maulfoster.com
Mary Benzinger	MFA Quality Assurance Specialist/Environmental Services Assistance Team	MFA, Portland, Oregon	Phone: (503) 501-5247 and e-mail: mbenzinger@maulfoster.com
Brian P. Reilly	Weston Solutions, Inc. Project Manager/ Associate Project Scientist	Weston Solutions, Inc., Walnut Creek, California	Phone: (541) 593-3800 and e-mail: brian.reilly@WestonSolutions.com

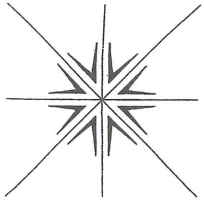
**SAMPLE PLAN ALTERATION FORM
FORMER FRONTIER HARD CHROME SITE**

Data Distribution List:					
Name	Title	Draft Data		Final Data	
		Electronic Copy	Hard Copy	Electronic Copy	Hard Copy
Bill Ryan	USEPA Project Manager	X		X	(two copies)
Panjini Balaraju	Ecology Project Manager	X		X	
Andrew Vidourek	MFA Project Manager	X		X	
MFA Project File	Not Applicable	X		X	
Mark Fleischauer	JH Kelly Senior Vice President	X		X	

**SAMPLE PLAN ALTERATION FORM
FORMER FRONTIER HARD CHROME SITE**

CONTACT, TITLE	APPROVED SIGNATURE	DATE
Initiator: Mark Fleischauer		6/20/16
MFA PM: Andrew W. Vidourek		6/20/16
USEPA PM: Bill Ryan		6/21/16
USEPA QA Manager or Designee: Donald Brown		6/21/16

Page ____ of ____



**11711 SE Capps Road
Clackamas, OR 97015
Phone: 503-607-1331
Fax: 503-607-1336**

Company _____

Address _____

Phone _____ Fax _____

Project No. _____ Project Name _____

Project Site Location OR _____ WA _____ Other _____

Invoice To _____ **P.O. No.** _____

Signature_____

Printed _____

Signature_____

Printed _____

☐ Rush _____

Rush Analyses Must Be Scheduled With The Lab In Advance

For Laboratory Use

Lab Job No. _____

Shipped Via _____

Air Bill No. _____

Temperature On Receipt _____ °C

Specialty Analytical Containers? Y / N

Specialty Analytical Trip Blanks? Y / N

No. of Containers

[illegible]

Maul Foster & Alongi, Inc.

400 E. Mill Plain Blvd, Suite 400, Vancouver, WA 98660 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name		Sample Location	
Project #		Sampler	
Project Name		Sampling Date	
Sampling Event		Sample Name	
Sub Area		Sample Depth	
FSDS QA:		Easting	
		Northing	
		TOC	

Hydrology/Level Measurements

					(Product Thickness)	(Water Column)	(Gallons/ft x Water Column)
Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW	DTB-DTW	Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

--

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
			VOA-Glass		No
			Amber Glass		Yes
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly		No
			Red Dissolved Poly		Yes
			Total Bottles	0	

General Sampling Comments

--

Signature_____

APPENDIX B

FIELD SAMPLING DATA SHEETS



Maul Foster & Alongi, Inc.

400 E. Mill Plain Blvd, Suite 400, Vancouver, WA 98660 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	385-3
Project #	1162.01.03	Sampler	AWV
Project Name	EPA ID# WAD053614988	Sampling Date	6/27/16
Sampling Event	June 2016	Sample Name	FHC-GW-W8503B-24.0
Sub Area		Sample Depth	24.0
FSDS QA:	ENR 9/1/16	Easting	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
6/27/16	0640	29.5		18.11		11.39	1.85

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
P-Pump	0650	.25	.200	7.02	14.00	925	0.46	52.0	5.98
	0655	.45	.200	6.86	14.07	1081	.22	38.4	9.17
	0700	.65	.200	6.67	14.44	1104	.19	18.7	4.56
	0705	.75	.200	6.43	14.45	1106	.20	19.2	3.60
	0710	1.0	.200	6.48	14.30	1112	.18	9.6	2.75
	0715	1.15	.200	6.48	14.32	1112	.17	8.4	2.54
Final Field Parameters	0720	1.5	.200	6.45	14.52	1110	.12	10.8	2.27

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

Clear, slight yellow tint. No odor. No sheen.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
P-Pump	GW	0730	VOA-Glass		No
			Amber Glass		Yes No
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly WAD03	1	No
			Red Dissolved Poly		Yes No
			Total Bottles	1	

General Sampling Comments

Begin purge @ 0645.
Historical depth to bottom.

Signature

Maul Foster & Alongi, Inc.

400 E. Mill Plain Blvd, Suite 400, Vancouver, WA 98660 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	B85-3				
Project #	1162-01-03	Sampler	AWV				
Project Name	EPAID# WAD053614988	Sampling Date	6/27/16				
Sampling Event	June 2016	Sample Name	FHC-GW-W053614988-24.0				
Sub Area		Sample Depth	24.0				
FSQS QA:	ENH 9/1/16	Easting		Northing		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Pump	0725	1.65	.200	6.43	14.50	1115	.12	9.6	1.70
	0730	2.0	.200	6.42	14.62	1111	.109	8.6	1.46
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

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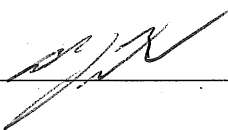
Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
			VOA-Glass		No
			Amber Glass		Yes
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly		No
			Red Dissolved Poly		Yes
			Total Bottles	0	

General Sampling Comments

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Signature



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Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	2A-MW-12A
Project #	1162.01.03	Sampler	AWV
Project Name	EPAID# WAD053614988	Sampling Date	6/27/16
Sampling Event	June 2016	Sample Name	FHC-GW-2A-MW-12A-25.0/2A-2
Sub Area		Sample Depth	25.0 - 23.0
FSDS QA:	ENR 9/1/16	Easting	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
6/27/16	1500	28.1		15.35		12.75	2.1

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	- EH	Turbidity
P-Pump	1510	.1	.075	3.48	23.10	1671	1.26	285.3	34.8
	1515	.2	.050	2.88	24.37	1694	1.26	301.3	32.7
	1520	.25	.050	2.63	24.96	1699	0.96	309.4	29.4
	1525	.30	0.110	2.44	25.52	1701	0.82	317.8	28.2
	1530	.35	0.110	2.58	23.84	1755	0.80	319.1	25.9
	1535	.40	0.100	3.29	21.75	1731	0.67	214.3	46.1
Final Field Parameters	1540	.45	0.100	3.18	22.01	1725	0.64	295	42.0

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

Slightly turbid. Slight sulfur-like odor. Cloudy.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
P-Pump	GW	1625	VOA-Glass		No
			Amber Glass		Yes No
			White Poly	2	No Yes
			Yellow Poly		No
			Green Poly		No
			Red Total Poly		No
			Red Dissolved Polymers	2	Yes
			Total Bottles	8 + 4 = 8 total	

General Sampling Comments

Begin purge @ 1500
4 bottles for FHC-GW-MW-12A-23.0
4 bottles for QA-2
Historical depth to bottom.

2 white poly
2 white poly filtered
2 red poly
2 red poly filtered

Signature

[Signature]

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Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	RA-MW-12A				
Project #	1162-01-03	Sampler	AWV				
Project Name	EAMIDAWAD053(214988	Sampling Date	6/27/12				
Sampling Event	June 2012	Sample Name	FHC-6W-MW12A-23.0/GA2				
Sub Area		Sample Depth	23.0				
FSDS QA:	ENH 5/1/16	Easting		Northing		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Final Field Parameters	1545	1.50	0.100	3.35	20.81	1748	0.68	294.2	39.4
	1555	1.0	0.100	2.86	22.39	1725	0.62	325.9	32.1
	1610	1.5	0.100	3.96	23.45	1771	1.08	40.1	42.1
	1615	1.7	0.110	6.16	22.45	2101	0.90	-253.0	40.7
	1620	1.85	0.110	6.84	23.19	2184	0.08	-298.1	38.5
	1625	2.0	0.110	7.07	23.59	2243	6.05	-290.9	38.3

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
			VOA-Glass		No
			Amber Glass		Yes
			White Poly		No
			Yellow-Poly		No
			Green Poly		No
			Red Total Poly		No
			Red Dissolved Poly		Yes
			Total Bottles	0	

General Sampling Comments

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Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	2A-MW-12B
Project #	1162-01-03	Sampler	AWV
Project Name	EPA3DDEWAD053614988	Sampling Date	6/27/16
Sampling Event	June 2016	Sample Name	FHC-GW-MW12B-25.0
Sub Area		Sample Depth	25.0
FSDS QA:	EDH 9/1/16	Easting	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
6/27/16	1340	33.0		19.42		13.58	2.21

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	- EH	Turbidity
P-Pump	1345	.260	.200	7.55	19.62	687	4.52	100.3	1.00
	1350	.3	.200	7.16	17.94	684	3.76	91.1	0.9
	1355	.4	.200	7.10	17.79	685	4.14	88.5	1.31
	1405	.5	.180	6.84	17.33	894	1.92	67.4	1.27
	1410	.6	.180	6.86	17.32	958	0.57	4.3	0.88
	1415	.75	.190	6.88	17.32	969	0.35	24.5	0.78
Final Field Parameters	1420	1.0	.100	6.86	17.38	978	0.24	32.5	1.01

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear, no odor, no sheen.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
P-Pump	GW	1435	VOA-Glass		No
			Amber Glass		Yes No
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly + ND3	1	No
			Red Dissolved Poly		Yes No
			Total Bottles	1	

General Sampling Comments

Begin purge @ 1340.
Historical depth to bottom.

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Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	2A-MW-123				
Project #	1162.01.03	Sampler	AWV				
Project Name	EPAID# WA0053614988	Sampling Date	6/27/14				
Sampling Event	June 2014	Sample Name	FHC-GW-MW123-25.0				
Sub Area		Sample Depth	25.0				
FSDS QA:	EPH 9/1/16	Easting		Northing		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Final Field Parameters	1425	1.5	.200	6.87	17.23	984	0.18	-37.6	0.85
	1430	1.7	.200	6.86	17.28	990	0.13	-44.6	0.75
	1435	1.9	.200	6.87	17.19	991	0.12	-47.5	1.00

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

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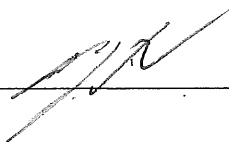
Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
		1435	VOA-Glass		No
			Amber Glass		Yes
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly		No
			Red Dissolved Poly		Yes
			Total Bottles	0	

General Sampling Comments

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Signature



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Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	RA-MW-12C
Project #	1162.01.03	Sampler	ALV
Project Name	EPAID# WAD053614988	Sampling Date	6/28/16
Sampling Event	June 2016	Sample Name	FHC-GW-MW12C-25.0
Sub Area		Sample Depth	25.0
FSDS QA:	END 5/1/16	Easting	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
6/28/16	0645	39.2		19.31		19.89	3.24

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	- EH	Turbidity
P-Pump	0700	.25	.200	6.75	14.61	923	0.56	-257.0	1.5
	0705	.50	.240	6.65	14.61	918	0.41	-259.3	1.22
	0710	.75	.225	6.90	14.64	893	0.27	-264.3	1.20
	0715	1.0	.225	7.05	14.65	880	0.25	-265.9	1.16
	0720	1.25	.225	7.04	14.86	859	0.19	-255.7	1.04
	0725	1.75	.225	7.03	14.75	864	0.19	-259.7	1.19
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Slight odor. Clear. No sheen.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
P-Pump	GW	0725	VOA-Glass		No
			Amber Glass		Yes No
			White Poly	2	No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly HNO ₃	1	No
			Red Dissolved Poly		Yes No
			Total Bottles	01	

General Sampling Comments

Begin purge @ 0648.
Historical depth to bottom.

Signature

page 11.

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Water Field Sampling Data Sheet

Client Name	Forbes FHC	Sample Location	2A-MW-15A
Project #	1162.01.03	Sampler	AWV
Project Name	EPAID#WA0053614988	Sampling Date	6/27/16
Sampling Event	June 2016	Sample Name	FHC-GW-MW15A-24.0
Sub Area		Sample Depth	24.0
FSDS QA:	BNH 9/1/16	Easting	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
6/27/16	1215	26.6		19.01		7.59	1.24

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	- EH	Turbidity
P-pump	1220	0.2	.200	7.37	20.68	970	0.70	77.7	5.30
	1225	0.4	.200	6.94	19.01	974	0.20	30.2	2.76
	1230	0.5	.180	6.93	18.94	974	0.19	28.9	2.64
	1235	.65	.200	6.81	18.42	975	.18	14.6	2.54
	1240	.80	.200	6.72	18.39	955	.14	13.9	2.61
	1245	1.0	.200	6.6	18.38	954	.14	15.9	2.28
Final Field Parameters	1250	1.25	.200	6.57	18.37	954	.14	17.0	2.22

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear. No odor. No smell.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
P-pump	GW	1300	VOA-Glass		No
			Amber Glass		Yes No
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly HNO ₃	1	No
			Red Dissolved Poly		Yes No
			Total Bottles	1	

General Sampling Comments

Begin purge @ 1215.
Historical depth to bottom.

Signature

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Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	2A-MW-15A				
Project #	1162.01-03	Sampler	AWV				
Project Name	EAAISIIWAD053614988	Sampling Date	6/27/16				
Sampling Event	JUNE 2016	Sample Name	FHC-60-MW15A-24.0				
Sub Area		Sample Depth	24.0				
FSDS QA:	EDH 9/1/16	Easting		Northing		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Final Field Parameters	1255	1.5	.200	6.50	18.43	954	0.15	16.4	3.95
	1300	1.7	.170	6.42	19.18	954	0.18	11.6	4.78

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

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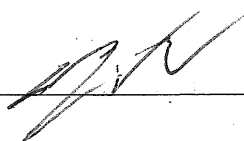
Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
		1300	VOA-Glass		No
			Amber Glass		Yes
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly		No
			Red Dissolved Poly		Yes

General Sampling Comments

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Signature



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Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	RA-MW-15B
Project #	1162.01.03	Sampler	AWV
Project Name	EPAID ILWADO53614488	Sampling Date	6/27/16
Sampling Event	June 2016	Sample Name	FHC-GW-MW15B-24.0 / QA-1
Sub Area		Sample Depth	24.0
FSDS QA:	BNH 9/1/16	Easting	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
6/27/16	1120	32.7		19.05		13.65	2.22

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge-Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	- EH	Turbidity
P-Pump	1125	.25	.200	7.82	18.05	600	0.37	94.1	1.10
	1130	.50	.700	7.13	17.14	610	0.17	68.1	2.01
	1135	.75	.200	6.85	16.94	610	0.11	46.7	1.73
	1140	1.0	.200	6.80	16.93	611	0.08	34.2	2.01
	1145	1.25	.200	6.73	16.92	613	0.07	30.1	2.09
	1150	2.0	.200	6.76	16.82	614	0.08	28.6	1.73
Final Field Parameters	1155	2.75	.200	6.73	16.71	615	0.08	27.1	1.85

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear. Noodor, no sheen.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
P-Pump	GW	1155	VOA-Glass		No
			Amber Glass		Yes
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly	2	No
			Red Dissolved Poly	2	Yes
			Total Bottles	2 + 2 = 4 total	

General Sampling Comments

Began purge @ 1120.
2 bottles for FHC-GW-MW15B-24.0
2 bottles for QA-1.
Historical depth to bottom.

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Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	2A-MW-16A
Project #	1162.01-03	Sampler	AWJ
Project Name	EPA ID# WAD053614486	Sampling Date	6/28/14
Sampling Event	June 2014	Sample Name	FHC-GW-MW16A-25.0
Sub Area		Sample Depth	25.0
FSDS QA:	END 9/1/16	Easting	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
6/28/14	0935	26.24		19.4		7.84	1.3

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	- EH	Turbidity
P-pump	0940	.25	.225	6.91	15.74	528	1.02	-15.7	39.4
	0950	.5	.225	6.19	15.69	528	0.72	-21.9	19.2
	1000	.75	.225	5.48	15.72	530	0.58	-40.9	16.0
	1005	1.25	.200	5.51	16.15	532	0.51	-39.3	13.0
	1010	1.75	.200	5.55	16.40	534	0.45	-41.1	11.2
	1015	2.25	.200	5.47	16.57	537	0.39	-42.2	9.71
	1020	2.5	.200	5.46	17.26	539	0.38	-43.3	8.82
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

Slightly turbid. No odor. No sheen.
Small worm-like creatures in purge water.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
P-pump	GW	1025	VOA-Glass		No
			Amber Glass		Yes No
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly #103	1	No
			Red Dissolved Poly		Yes No
			Total Bottles	1	

General Sampling Comments

Begin purge @ 0930.
0945 - Drain flow through cell, begin pumping again.
measured depth to bottom 6/28/14.

Signature

Maul Foster & Alongi, Inc.

400 E. Mill Plain Blvd, Suite 400, Vancouver, WA 98660 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	RAMW-16A				
Project #	1162-01-03	Sampler	AWV				
Project Name	FAAD01WA0053Q14988	Sampling Date	6/28/16				
Sampling Event	June 2016	Sample Name	FHC-GW-MW16A-25.0				
Sub Area		Sample Depth	25.0				
FSDS QA:	FSH 9/1/16	Easting		Northing		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
	1025	2.7	120	5.52	17.90	540	0.38	-45.4	8.07
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

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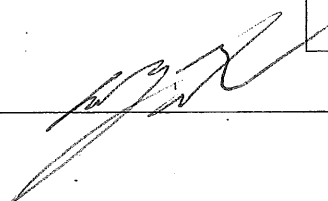
Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
		1025	VOA-Glass		No
			Amber Glass		Yes
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly		No
			Red Dissolved Poly		Yes
			Total Bottles	0	

General Sampling Comments

--

Signature



Maul Foster & Alongi, Inc.

400 E. Mill Plain Blvd, Suite 400, Vancouver, WA 98660 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	RA-MW-14B
Project #	1102.01.03	Sampler	AWV
Project Name	ERAIDAWAD053614438	Sampling Date	6/28/16
Sampling Event	June 2016	Sample Name	FHC-GW-MW103-25.0
Sub Area		Sample Depth	25.0
FSDS QA:	BNH 9/1/16	Easting	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
6/28/16	0832	45		18.72		24.28	4.3

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	-EH	Turbidity
P-Pump	0840	.25	.225	6.62	14.85	343	7.94	-7.7	0.98
	0845	.5	.230	6.62	14.87	538	2.14	-52.4	0.81
	0850	.75	.225	6.55	14.89	575	1.43	-37.0	0.78
	0855	1.0	.225	6.43	14.98	597	0.80	-41.1	0.80
	0900	1.5	.225	6.36	15.01	610	0.59	-44.2	1.24
	0905	2.0	.225	6.34	15.00	612	0.54	-46.5	0.90
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

Clear. No odor. No sheen

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
P-Pump	GW	0905	VOA-Glass		No
			Amber Glass		Yes No
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly HNO3	1	No
			Red Dissolved Poly		Yes No
			Total Bottles	2	

General Sampling Comments

Begin purge @ 0835.
Historical depth to bottom.

Signature

page 1/1

Maul Foster & Alongi, Inc.

400 E. Mill Plain Blvd, Suite 400, Vancouver, WA 98660 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	2A-MW-17A
Project #	1162.01.03	Sampler	AWV
Project Name	WAB EPAID# 653614988	Sampling Date	6/27/14
Sampling Event	June 2014	Sample Name	FHC-GW-MW17A-24.0
Sub Area		Sample Depth	24.0
FSDS QA:	EPH 9/1/14	Easting	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
6/28/14	0737	26.4		19.19		7.21	1.2

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	- EH	Turbidity
P-Pump	0745	.50	.225	6.06	14.95	818	0.64	-181.4	0.97
	0750	.50	.225	5.90	14.99	823	0.62	-182.9	1.00
	0755	.75	.230	5.83	15.03	833	0.63	-183.6	0.85
	0800	1.25	.230	5.78	15.06	844	0.63	-183.2	0.80
	0805	2.0	.230	5.76	15.07	851	0.64	-182.9	0.89
	0810	2.25	.230	5.76	15.06	861	0.59	-182.3	0.79
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear. No odor. No shen.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
P-Pump	GW	0810	VOA-Glass		No
			Amber Glass		Yes
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly H2O3	1	No
			Red Dissolved Poly		Yes
			Total Bottles	91	

General Sampling Comments

Begin purge @ 0740.
Historical depth to bottom.

Signature

Maul Foster & Alongi, Inc.

400 E. Mill Plain Blvd, Suite 400, Vancouver, WA 98660 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	W92-16A
Project #	1162.01.03	Sampler	AWV
Project Name	EPA ID# WAD053014938	Sampling Date	6/27/14
Sampling Event	June 2014	Sample Name	FHC-GW-W9216A-25.0
Sub Area		Sample Depth	25.0
FSDS QA:	BNH 5/1/14	Easting	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
6/27/14	0803	34		13.86		15.14	9.88

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	- EH	Turbidity
P-Pump	0810	.25	.200	7.29	16.61	108	6.3	51.7	4.94
	0815	.35	.200	7.07	16.64	165	3.43	51.5	3.77
	0820	.5	.200	7.04	16.64	170	2.97	50.6	3.38
	0825	.6	.200	6.94	16.71	198	1.61	38.7	3.01
	0830	.75	.200	6.41	16.74	210	.75	31.2	2.64
	0835	.90	.200	6.81	16.89	225	.42	24.6	2.01
	0840	1.1	.200	6.78	17.00	244	.25	6.1	1.85
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear. No Sreen. No odor.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
P-Pump	GW	0915	VOA-Glass		No
			Amber Glass		Yes No
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly H ₂ O ₂	1	No
			Red Dissolved Poly		Yes No
			Total Bottles	1	

General Sampling Comments

Begin purge @ 0805.
Historical - depth to bottom.

Signature

Maul Foster & Alongi, Inc.

400 E. Mill Plain Blvd, Suite 400, Vancouver, WA 98660 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	402-16A
Project #	1162.01.03	Sampler	AWI
Project Name	EPAID#WAD053Q14988	Sampling Date	6/27/10
Sampling Event	June 2010	Sample Name	FHC-GW-40216A-25.0
Sub Area		Sample Depth	25.0
FSDS QA:	ENH 9/1/10	Easting	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Final Field Parameters	0845	1.25	.200	6.65	17.01	240	.20	-8.0	1.64
	0850	1.50	.200	6.79	16.97	253	.18	-7.8	1.57
	0855	1.65	.200	6.79	16.98	253	.18	-6.8	1.49
	0900	2.0	.200	6.78	17.02	252	.19	-5.9	1.42
	0905	2.25	.200	6.76	16.90	253	.16	-9.6	1.24
	0910	2.50	.200	6.69	17.01	253	.18	-10.4	1.30
	0915	2.75	.200	6.67	17.11	253	.17	-12.7	1.36

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

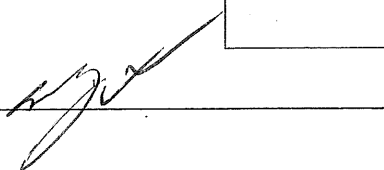
Water Quality Observations:

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
		0915	VOA-Glass		No
			Amber Glass		Yes
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly		No
			Red Dissolved Poly.		Yes
			Total Bottles	0	

General Sampling Comments

Signature



Maul Foster & Alongi, Inc.

400 E. Mill Plain Blvd, Suite 400, Vancouver, WA 98660 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	W92-108
Project #	1162.01.03	Sampler	AWJ
Project Name	EPA ID# WAD053614988	Sampling Date	6/27/12
Sampling Event	June 2012	Sample Name	FHC-W-692163-250
Sub Area		Sample Depth	25.0
FSDS QA:	ENH 9/1/16	Easting	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
6/27/12	0920	45		18.75		26.25	17.14

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	- EH	Turbidity
P-Pump	0945	.25	.200	6.96	17.51	204	3.87	95.7	4.96
	0950	.50	.200	6.81	17.42	199	1.62	82.1	3.85
	0955	.65	.200	6.70	17.56	175	2.42	59.7	2.74
	1000	.80	.200	6.69	17.57	169	2.89	54.4	1.69
	1005	1.0	.200	6.44	17.80	169	2.88	55.5	1.05
	1010	1.25	.200	6.40	19.85	170	2.98	50.2	1.09
Final Field Parameters	1015	1.50	.200	6.39	20.56	170	2.90	51.6	1.15

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

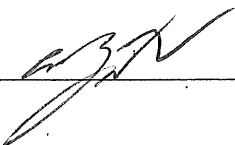
Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
P-Pump	GW	1035	VOA-Glass		No
			Amber Glass		Yes No
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly WAD03	1	No
			Red Dissolved Poly		Yes No
			Total Bottles	81	

General Sampling Comments

Begin purge @ 0940.
Historical depth to bottom

Signature



Maul Foster & Alongi, Inc.

400 E. Mill Plain Blvd, Suite 400, Vancouver, WA 98660 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location	W92-163				
Project #	1162.01.03	Sampler	ASV				
Project Name	EPATDWWAD053614938	Sampling Date	6/27/14				
Sampling Event	June 2014	Sample Name	FHC-GW-W92163-25.0				
Sub Area		Sample Depth	25.0				
FSDS QA:	EDH 9/1/16	Easting		Northing		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Final Field Parameters	1020	1.7	1200	6.40	20.59	169	2.90	50.3	1.15
	1025	2.0	1200	6.38	20.61	170	2.92	51.0	0.99
	1030	2.25	1200	6.38	20.70	171	2.89	49.2	1.00
	1035	2.70	1200	6.39	20.50	170	2.90	48.1	1.23

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

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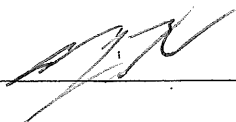
Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
		1035	VOA-Glass		No
			Amber Glass		Yes
			White Poly		No
			Yellow Poly		No
			Green Poly		No
			Red Total Poly		No
			Red Dissolved Poly		Yes
			Total Bottles	0	

General Sampling Comments

--

Signature



Maul Foster & Alongi, Inc.

400 E. Mill Plain Blvd, Suite 400, Vancouver, WA 98660 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name	Former FHC	Sample Location					
Project #	1162-01-03	Sampler	AWV				
Project Name	EPASD WAD053614988	Sampling Date	6/27/16				
Sampling Event	June 2016	Sample Name	Filter Blank				
Sub Area		Sample Depth					
FSDS QA:		Easting		Northing		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	- EH	Turbidity
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

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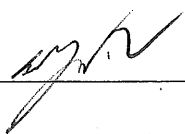
Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
P-Pump		0845	VOA-Glass		No
			Amber Glass		Yes No
			White Poly	1	No Yes
			Yellow Poly		No
			Green Poly		No
			Red Total Poly HNO3	1	No Yes
			Red Dissolved Poly		Yes No
			Total Bottles	02	

General Sampling Comments

used lab supplied DI water to collect filter blank.

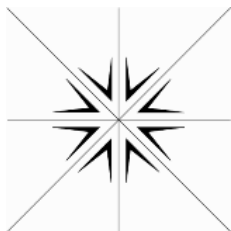
Signature



APPENDIX C

LABORATORY ANALYTICAL RESULTS





Specialty Analytical

11711 SE Capps Road, Ste B
Clackamas, Oregon 97015
TEL: 503-607-1331 FAX: 503-607-1336
Website: www.specialtyanalytical.com

July 15, 2016

Andrew Vidourek
Maul Foster & Alongi
400 E. Mill Plain Blvd.
Suite 400
Vancouver, WA 98660
TEL: (360) 694-2691
FAX: (360) 906-1958
RE: Former FHC / 1162.01.03

Dear Andrew Vidourek:

Order No.: 1606234

Specialty Analytical received 14 sample(s) on 6/28/2016 for the analyses presented in the following report.

There were no problems with the analysis and all data for associated QC met EPA or laboratory specifications, except where noted in the Case Narrative, or as qualified with flags. Results apply only to the samples analyzed. Without approval of the laboratory, the reproduction of this report is only permitted in its entirety.

If you have any questions regarding these tests, please feel free to call.

Sincerely,

A handwritten signature in black ink, appearing to read "Marty French". The signature is fluid and cursive, with the first name "Marty" being more prominent.

Marty French
Lab Director

Specialty Analytical

Date Reported: 15-Jul-16

CLIENT: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

Lab Order: 1606234

Lab ID: 1606234-001 **Collection Date:** 6/27/2016 7:30:00 AM
Client Sample ID: FHC-GW-W8503B-24.0 **Matrix:** GROUNDWATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
ICP/MS METALS-TOTAL RECOVERABLE		SW6020A				Analyst: jw
Chromium	0.130	0.100		µg/L	1	6/30/2016 11:18:50 AM

Lab ID: 1606234-002 **Collection Date:** 6/27/2016 8:45:00 AM
Client Sample ID: Filter Blank **Matrix:** WATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
ICP/MS METALS-DISSOLVED RECOVERABLE		SW6020A				Analyst: JRC
Chromium	ND	0.100		µg/L	1	7/1/2016 9:49:50 AM
HEXAVALENT CHROMIUM-DISSOLVED		M3500-CR D				Analyst: EFH
Chromium, Hexavalent Dissolved	ND	5.00	HT	µg/L	1	6/28/2016 3:02:24 PM
SUB CONTRACTING		SUB CONTRACTING				Analyst: ZL
Sulfur	<.1	0		mg/L	1	7/12/2016 1:49:05 PM

Lab ID: 1606234-003 **Collection Date:** 6/27/2016 9:15:00 AM
Client Sample ID: FHC-GW-W9216A-25.0 **Matrix:** GROUNDWATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
ICP/MS METALS-TOTAL RECOVERABLE		SW6020A				Analyst: jw
Chromium	ND	0.100		µg/L	1	6/30/2016 11:22:13 AM

Lab ID: 1606234-004 **Collection Date:** 6/27/2016 10:35:00 AM
Client Sample ID: FHC-GW-W9216B-25.0 **Matrix:** GROUNDWATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
ICP/MS METALS-TOTAL RECOVERABLE		SW6020A				Analyst: jw
Chromium	ND	0.100		µg/L	1	7/1/2016 10:11:48 AM

Specialty Analytical

Date Reported: 15-Jul-16

CLIENT: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

Lab Order: 1606234

Lab ID: 1606234-005 **Collection Date:** 6/27/2016 11:55:00 AM
Client Sample ID: FHC-GW-MW15B-24.0 **Matrix:** GROUNDWATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
ICP/MS METALS-TOTAL RECOVERABLE		SW6020A				Analyst: jw
Chromium	ND	0.100		µg/L	1	7/1/2016 10:13:29 AM
ICP/MS METALS-DISSOLVED RECOVERABLE		SW6020A				Analyst: JRC
Chromium	ND	0.100		µg/L	1	7/1/2016 9:51:31 AM

Lab ID: 1606234-006 **Collection Date:** 6/27/2016 11:55:00 AM
Client Sample ID: QA-1 **Matrix:** GROUNDWATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
ICP/MS METALS-TOTAL RECOVERABLE		SW6020A				Analyst: jw
Chromium	ND	0.100		µg/L	1	7/1/2016 10:15:10 AM
ICP/MS METALS-DISSOLVED RECOVERABLE		SW6020A				Analyst: JRC
Chromium	ND	0.100		µg/L	1	7/1/2016 9:53:12 AM

Lab ID: 1606234-007 **Collection Date:** 6/27/2016 1:00:00 PM
Client Sample ID: FHC-GW-MW15A-24.0 **Matrix:** GROUNDWATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
ICP/MS METALS-TOTAL RECOVERABLE		SW6020A				Analyst: jw
Chromium	ND	0.100		µg/L	1	7/1/2016 10:16:52 AM

Lab ID: 1606234-008 **Collection Date:** 6/27/2016 2:35:00 PM
Client Sample ID: FHC-GW-MW12B-25.0 **Matrix:** GROUNDWATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
ICP/MS METALS-TOTAL RECOVERABLE		SW6020A				Analyst: jw
Chromium	ND	0.100		µg/L	1	7/1/2016 10:18:33 AM

Specialty Analytical

Date Reported: 15-Jul-16

CLIENT: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

Lab Order: 1606234

Lab ID: 1606234-009
Client Sample ID: FHC-GW-MW12A-23.0

Collection Date: 6/27/2016 4:25:00 PM
Matrix: GROUNDWATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
ICP/MS METALS-TOTAL RECOVERABLE		SW6020A				Analyst: jw
Chromium	7.48	0.100		µg/L	1	7/1/2016 10:20:14 AM
ICP/MS METALS-DISSOLVED RECOVERABLE		SW6020A				Analyst: JRC
Chromium	1.13	0.100		µg/L	1	7/1/2016 9:54:53 AM
HEXAVALENT CHROMIUM-DISSOLVED		M3500-CR D				Analyst: EFH
Chromium, Hexavalent Dissolved	ND	5.00		µg/L	1	6/28/2016 3:03:24 PM
HEXAVALENT CHROMIUM		M 3500 CR B				Analyst: EFH
Chromium, Hexavalent	ND	5.00		µg/L	1	6/28/2016 3:02:19 PM
SUB CONTRACTING		SUB_CONTRACTING				Analyst: ZL
Sulfur	11.0	0		mg/L	1	7/12/2016 1:49:05 PM
ANIONS BY IC		E300.0				Analyst: EFH
Sulfate	1220	25.0		mg/L	100	6/29/2016 11:42:00 AM

Specialty Analytical

Date Reported: 15-Jul-16

CLIENT: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

Lab Order: 1606234

Lab ID: 1606234-010

Collection Date: 6/27/2016 4:25:00 PM

Client Sample ID: QA-2

Matrix: GROUNDWATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
ICP/MS METALS-TOTAL RECOVERABLE		SW6020A				Analyst: jw
Chromium	14.8	0.100		µg/L	1	7/1/2016 10:21:55 AM
ICP/MS METALS-DISSOLVED RECOVERABLE		SW6020A				Analyst: JRC
Chromium	1.07	0.100		µg/L	1	7/1/2016 9:56:34 AM
HEXAVALENT CHROMIUM-DISSOLVED		M3500-CR D				Analyst: EFH
Chromium, Hexavalent Dissolved	ND	5.00		µg/L	1	6/28/2016 3:04:24 PM
HEXAVALENT CHROMIUM		M 3500 CR B				Analyst: EFH
Chromium, Hexavalent	ND	5.00		µg/L	1	6/28/2016 3:03:19 PM
SUB CONTRACTING		SUB_CONTRACTING				Analyst: ZL
Sulfur	13.3	0		mg/L	1	7/12/2016 1:49:05 PM
ANIONS BY IC		E300.0				Analyst: EFH
Sulfate	1160	25.0		mg/L	100	6/29/2016 12:03:00 PM

Lab ID: 1606234-011

Collection Date: 6/28/2016 7:25:00 AM

Client Sample ID: FHC-GW-MW12C-25.0

Matrix: GROUNDWATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
ICP/MS METALS-TOTAL RECOVERABLE		SW6020A				Analyst: jw
Chromium	ND	0.100		µg/L	1	7/1/2016 10:27:00 AM

Lab ID: 1606234-012

Collection Date: 6/28/2016 8:10:00 AM

Client Sample ID: FHC-GW-MW17A-24.0

Matrix: GROUNDWATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
ICP/MS METALS-TOTAL RECOVERABLE		SW6020A				Analyst: jw
Chromium	ND	0.100		µg/L	1	7/1/2016 10:28:42 AM

Specialty Analytical

Date Reported: 15-Jul-16

CLIENT: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

Lab Order: 1606234

Lab ID: 1606234-013 **Collection Date:** 6/28/2016 9:05:00 AM

Client Sample ID: FHC-GW-MW16B-25.0 **Matrix:** GROUNDWATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
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ICP/MS METALS-TOTAL RECOVERABLE		SW6020A				Analyst: jw
Chromium	ND	0.100		µg/L	1	7/1/2016 10:30:23 AM

Lab ID: 1606234-014 **Collection Date:** 6/28/2016 10:25:00 AM

Client Sample ID: FHC-GW-MW16A-25.0 **Matrix:** GROUNDWATER

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
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ICP/MS METALS-TOTAL RECOVERABLE		SW6020A				Analyst: jw
Chromium	ND	0.100		µg/L	1	7/1/2016 10:32:04 AM

QC SUMMARY REPORT

WO#: 1606234

15-Jul-16

Specialty Analytical

Client: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

TestCode: 300_DW

Sample ID: LOW CHECK 0.25	SampType: ICV	TestCode: 300_DW	Units: mg/L	Prep Date:	RunNo: 25722						
Client ID: ICV	Batch ID: R25722	TestNo: E300.0		Analysis Date: 6/28/2016	SeqNo: 346716						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate	0.264	0.250	0.2500	0	106	70	130				

Sample ID: MBLK	SampType: MBLK	TestCode: 300_DW	Units: mg/L	Prep Date:	RunNo: 25722						
Client ID: PBW	Batch ID: R25722	TestNo: E300.0		Analysis Date: 6/28/2016	SeqNo: 346717						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate	ND	0.250									

Sample ID: A1606222-001ADUP	SampType: DUP	TestCode: 300_DW	Units: mg/L	Prep Date:	RunNo: 25722						
Client ID: ZZZZZZ	Batch ID: R25722	TestNo: E300.0		Analysis Date: 6/28/2016	SeqNo: 346719						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate	10.3	0.250						10.23	0.653	20	

Sample ID: A1606222-001AMS	SampType: MS	TestCode: 300_DW	Units: mg/L	Prep Date:	RunNo: 25722						
Client ID: ZZZZZZ	Batch ID: R25722	TestNo: E300.0		Analysis Date: 6/28/2016	SeqNo: 346720						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate	18.8	0.250	10.00	10.23	85.6	75	125				

Qualifiers: B Analyte detected in the associated Method Blank H Holding times for preparation or analysis exceeded ND Not Detected at the Reporting Limit Page 1 of 10
O RSD is greater than RSDlimit R RPD outside accepted recovery limits S Spike Recovery outside accepted reco

QC SUMMARY REPORT

WO#: 1606234

15-Jul-16

Specialty Analytical

Client: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

TestCode: 300_DW

Sample ID: A1606222-001AMSD	SampType: MSD	TestCode: 300_DW	Units: mg/L	Prep Date:	RunNo: 25722						
Client ID: ZZZZZZ	Batch ID: R25722	TestNo: E300.0	Analysis Date: 6/28/2016	SeqNo: 346721							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Sulfate	19.0	0.250	10.00	10.23	87.4	75	125	18.80	0.928	20	
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Sample ID: CCV 15	SampType: CCV	TestCode: 300_DW	Units: mg/L	Prep Date:				RunNo: 25722			
Client ID: CCV	Batch ID: R25722	TestNo: E300.0	Analysis Date: 6/29/2016				SeqNo: 346839				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Sulfate	15.7	0.250	15.00	0	105	90	110				
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Sample ID: CCV 25		SampType: CCV		TestCode: 300_DW		Units: mg/L		Prep Date:			RunNo: 25722		
Client ID: CCV		Batch ID: R25722		TestNo: E300.0		Analysis Date: 6/29/2016			SeqNo: 346840				
Analyte		Result		PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Sulfate	22.8	0.250	25.00	0	91.2	90	110				
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Sample ID: LCS 15		SampType: LCS	TestCode: 300_DW		Units: mg/L	Prep Date:				RunNo: 25722		
Client ID: LCSW		Batch ID: R25722	TestNo: E300.0			Analysis Date: 6/29/2016				SeqNo: 346841		
Analyte		Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Sulfate	13.7	0.250	15.00	0	91.5	85	115				
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Qualifiers:	B	Analyte detected in the associated Method Blank	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit	Page 2 of 10
	O	RSD is greater than RSDlimit	R	RPD outside accepted recovery limits	S	Spike Recovery outside accepted reco	

QC SUMMARY REPORT

WO#: 1606234

15-Jul-16

Specialty Analytical

Client: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

TestCode: 300_DW

Sample ID: LOW CHECK 0.25	SampType: ICV	TestCode: 300_DW	Units: mg/L	Prep Date:					RunNo: 25722		
Client ID: ICV	Batch ID: R25722	TestNo: E300.0		Analysis Date: 6/29/2016					SeqNo: 346842		
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate	ND	0.250	0.2500	0	82.7	70	130				

Sample ID: MBLK	SampType: CCB	TestCode: 300_DW	Units: mg/L	Prep Date:	RunNo: 25722						
Client ID: CCB	Batch ID: R25722	TestNo: E300.0		Analysis Date: 6/29/2016	SeqNo: 346843						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfate	ND	0.250									

Qualifiers: B Analyte detected in the associated Method Blank
O RSD is greater than RSDlimit

H Holding times for preparation or analysis exceeded
R RPD outside accepted recovery limits

ND Not Detected at the Reporting Limit
S Spike Recovery outside accepted reco

QC SUMMARY REPORT

WO#: 1606234

15-Jul-16

Specialty Analytical

Client: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

TestCode: 6020_W

Sample ID: ICV	SampType: ICV	TestCode: 6020_W	Units: µg/L	Prep Date:	RunNo: 25746						
Client ID: ICV	Batch ID: 11552	TestNo: SW6020A	SW3010A	Analysis Date: 6/30/2016	SeqNo: 346918						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	49.7	0.100	50.00	0	99.3	90	110				

Sample ID: MB-11552	SampType: MBLK	TestCode: 6020_W	Units: µg/L	Prep Date: 6/29/2016	RunNo: 25746						
Client ID: PBW	Batch ID: 11552	TestNo: SW6020A	SW3010A	Analysis Date: 6/30/2016	SeqNo: 346919						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.100									

Sample ID: LCS-11552	SampType: LCS	TestCode: 6020_W	Units: µg/L	Prep Date: 6/29/2016	RunNo: 25746						
Client ID: LCSW	Batch ID: 11552	TestNo: SW6020A	SW3010A	Analysis Date: 6/30/2016	SeqNo: 346920						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	46.7	0.100	50.00	0	93.4	80	120				

Sample ID: 1606232-001ADUP	SampType: DUP	TestCode: 6020_W	Units: µg/L	Prep Date: 6/29/2016	RunNo: 25746						
Client ID: ZZZZZZ	Batch ID: 11552	TestNo: SW6020A	SW3010A	Analysis Date: 6/30/2016	SeqNo: 346922						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	3.20	0.100						2.879	10.7	20	

Qualifiers: B Analyte detected in the associated Method Blank H Holding times for preparation or analysis exceeded ND Not Detected at the Reporting Limit Page 4 of 10
O RSD is greater than RSDlimit R RPD outside accepted recovery limits S Spike Recovery outside accepted reco

QC SUMMARY REPORT

WO#: 1606234

15-Jul-16

Specialty Analytical

Client: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

TestCode: 6020_W

Sample ID: 1606232-001AMS	SampType: MS	TestCode: 6020_W	Units: µg/L	Prep Date: 6/29/2016	RunNo: 25746						
Client ID: ZZZZZZ	Batch ID: 11552	TestNo: SW6020A	SW3010A	Analysis Date: 6/30/2016	SeqNo: 346923						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	54.0	0.100	50.00	2.879	102	70	130				

Sample ID: 1606232-001AMSD	SampType: MSD	TestCode: 6020_W	Units: µg/L	Prep Date: 6/29/2016	RunNo: 25746						
Client ID: ZZZZZZ	Batch ID: 11552	TestNo: SW6020A	SW3010A	Analysis Date: 6/30/2016	SeqNo: 346924						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	57.4	0.100	50.00	2.879	109	70	130	54.02	6.13	20	

Sample ID: CCB	SampType: CCB	TestCode: 6020_W	Units: µg/L	Prep Date:	RunNo: 25746						
Client ID: CCB	Batch ID: 11552	TestNo: SW6020A	SW3010A	Analysis Date: 6/30/2016	SeqNo: 346941						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.100									

Sample ID: ICV	SampType: ICV	TestCode: 6020_W	Units: µg/L	Prep Date:	RunNo: 25746						
Client ID: ICV	Batch ID: 11552	TestNo: SW6020A	SW3010A	Analysis Date: 7/1/2016	SeqNo: 347111						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	48.6	0.100	50.00	0	97.2	90	110				

Qualifiers: B Analyte detected in the associated Method Blank H Holding times for preparation or analysis exceeded ND Not Detected at the Reporting Limit Page 5 of 10
O RSD is greater than RSDlimit R RPD outside accepted recovery limits S Spike Recovery outside accepted reco

QC SUMMARY REPORT

WO#: 1606234

15-Jul-16

Specialty Analytical

Client: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

TestCode: 6020_W

Sample ID: CCV	SampType: CCV	TestCode: 6020_W	Units: µg/L	Prep Date:	RunNo: 25746						
Client ID: CCV	Batch ID: 11552	TestNo: SW6020A	SW3010A	Analysis Date: 7/1/2016	SeqNo: 347112						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	47.8	0.100	50.00	0	95.6	90	110				

Sample ID: CCV	SampType: CCV	TestCode: 6020_W	Units: µg/L	Prep Date:	RunNo: 25746						
Client ID: CCV	Batch ID: 11552	TestNo: SW6020A	SW3010A	Analysis Date: 7/1/2016	SeqNo: 347116						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	47.8	0.100	50.00	0	95.6	90	110				

Sample ID: CCV	SampType: CCV	TestCode: 6020_W	Units: µg/L	Prep Date:	RunNo: 25746						
Client ID: CCV	Batch ID: 11552	TestNo: SW6020A	SW3010A	Analysis Date: 7/1/2016	SeqNo: 347127						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	46.2	0.100	50.00	0	92.5	90	110				

Sample ID: CCV	SampType: CCV	TestCode: 6020_W	Units: µg/L	Prep Date:	RunNo: 25746						
Client ID: CCV	Batch ID: 11552	TestNo: SW6020A	SW3010A	Analysis Date: 7/1/2016	SeqNo: 347132						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	46.8	0.100	50.00	0	93.5	90	110				

Qualifiers: B Analyte detected in the associated Method Blank H Holding times for preparation or analysis exceeded ND Not Detected at the Reporting Limit Page 6 of 10
O RSD is greater than RSDlimit R RPD outside accepted recovery limits S Spike Recovery outside accepted reco

QC SUMMARY REPORT

WO#: 1606234

15-Jul-16

Specialty Analytical

Client: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

TestCode: 6020_WDISS

Sample ID: ICV	SampType: ICV	TestCode: 6020_WDISS	Units: µg/L	Prep Date:	RunNo: 25755						
Client ID: ICV	Batch ID: 11553	TestNo: SW6020A	SW3010A	Analysis Date: 7/1/2016	SeqNo: 347087						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	48.6	0.100	50.00	0	97.2	90	110				

Sample ID: MB-11553	SampType: MBLK	TestCode: 6020_WDISS	Units: µg/L	Prep Date: 6/30/2016	RunNo: 25755						
Client ID: PBW	Batch ID: 11553	TestNo: SW6020A	SW3010A	Analysis Date: 7/1/2016	SeqNo: 347088						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.100									

Sample ID: 1606232-001CDUP	SampType: DUP	TestCode: 6020_WDISS	Units: µg/L	Prep Date: 6/30/2016	RunNo: 25755						
Client ID: ZZZZZZ	Batch ID: 11553	TestNo: SW6020A	SW3010A	Analysis Date: 7/1/2016	SeqNo: 347094						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	ND	0.100						0	0	20	

Sample ID: 1606232-001CMS	SampType: MS	TestCode: 6020_WDISS	Units: µg/L	Prep Date: 6/30/2016	RunNo: 25755						
Client ID: ZZZZZZ	Batch ID: 11553	TestNo: SW6020A	SW3010A	Analysis Date: 7/1/2016	SeqNo: 347095						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	43.9	0.100	50.00	0	87.7	70	130				

Qualifiers: B Analyte detected in the associated Method Blank H Holding times for preparation or analysis exceeded ND Not Detected at the Reporting Limit Page 7 of 10
O RSD is greater than RSDlimit R RPD outside accepted recovery limits S Spike Recovery outside accepted reco

QC SUMMARY REPORT

WO#: 1606234

15-Jul-16

Specialty Analytical

Client: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

TestCode: 6020_WDISS

Sample ID: 1606232-001CMSD	SampType: MSD	TestCode: 6020_WDISS	Units: µg/L	Prep Date: 6/30/2016	RunNo: 25755						
Client ID: ZZZZZZ	Batch ID: 11553	TestNo: SW6020A	SW3010A	Analysis Date: 7/1/2016	SeqNo: 347096						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	45.5	0.100	50.00	0	91.1	70	130	43.85	3.77	20	

Sample ID: CCV	SampType: CCV	TestCode: 6020_WDISS	Units: µg/L	Prep Date:	RunNo: 25755						
Client ID: CCV	Batch ID: 11553	TestNo: SW6020A	SW3010A	Analysis Date: 7/1/2016	SeqNo: 347097						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	47.8	0.100	50.00	0	95.6	90	110				

Sample ID: CCV	SampType: CCV	TestCode: 6020_WDISS	Units: µg/L	Prep Date:	RunNo: 25755						
Client ID: CCV	Batch ID: 11553	TestNo: SW6020A	SW3010A	Analysis Date: 7/1/2016	SeqNo: 347105						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium	47.8	0.100	50.00	0	95.6	90	110				

Qualifiers: B Analyte detected in the associated Method Blank H Holding times for preparation or analysis exceeded ND Not Detected at the Reporting Limit Page 8 of 10
O RSD is greater than RSDlimit R RPD outside accepted recovery limits S Spike Recovery outside accepted reco

QC SUMMARY REPORT

WO#: 1606234

15-Jul-16

Specialty Analytical

Client: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

TestCode: CR6_CWA DISS

Sample ID: MB-R25716	SampType: MBLK	TestCode: CR6_CWA_DI	Units: µg/L	Prep Date:	RunNo: 25716						
Client ID: PBW	Batch ID: R25716	TestNo: M3500-Cr D	Analysis Date: 6/28/2016	SeqNo: 346587							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Chromium, Hexavalent Dissolved ND 5.00

Sample ID: LCS-R25716	SampType: LCS	TestCode: CR6_CWA_DI	Units: µg/L	Prep Date:	RunNo: 25716						
Client ID: LCSW	Batch ID: R25716	TestNo: M3500-Cr D		Analysis Date: 6/28/2016	SeqNo: 346588						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Chromium, Hexavalent Dissolved 48.0 5.00 50.00 0 96.0 90 110

Sample ID: 1606234-010DMS	SampType: MS	TestCode: CR6_CWA_DI	Units: µg/L	Prep Date:	RunNo: 25716						
Client ID: QA-2	Batch ID: R25716	TestNo: M3500-Cr D	Analysis Date: 6/28/2016	SeqNo: 346592							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Chromium, Hexavalent Dissolved 19.4 5.00 50.00 0 38.7 75 125 S

Sample ID: 1606234-010DMSD	SampType: MSD	TestCode: CR6_CWA_DI	Units: µg/L	Prep Date:	RunNo: 25716						
Client ID: QA-2	Batch ID: R25716	TestNo: M3500-Cr D	Analysis Date: 6/28/2016	SeqNo: 346593							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Chromium, Hexavalent Dissolved 17.6 5.00 50.00 0 35.2 75 125 19.36 9.39 20 S

Qualifiers: B Analyte detected in the associated Method Blank H Holding times for preparation or analysis exceeded ND Not Detected at the Reporting Limit Page 9 of 10
O RSD is greater than RSDlimit R RPD outside accepted recovery limits S Spike Recovery outside accepted reco

QC SUMMARY REPORT

WO#: 1606234

15-Jul-16

Specialty Analytical

Client: Maul Foster & Alongi
Project: Former FHC / 1162.01.03

TestCode: CR6-CWA

Sample ID: MB-R25715	SampType: MBLK	TestCode: CR6-CWA	Units: µg/L	Prep Date:	RunNo: 25715						
Client ID: PBW	Batch ID: R25715	TestNo: M 3500 Cr B		Analysis Date: 6/28/2016	SeqNo: 346580						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium, Hexavalent	ND	5.00									

Sample ID: LCS-R25715	SampType: LCS	TestCode: CR6-CWA	Units: µg/L	Prep Date:	RunNo: 25715						
Client ID: LCSW	Batch ID: R25715	TestNo: M 3500 Cr B		Analysis Date: 6/28/2016	SeqNo: 346581						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium, Hexavalent	48.0	5.00	50.00	0	96.0	90	110				

Sample ID: A1606234-010DMS	SampType: MS	TestCode: CR6-CWA	Units: µg/L	Prep Date:	RunNo: 25715						
Client ID: ZZZZZZ	Batch ID: R25715	TestNo: M 3500 Cr B	Analysis Date: 6/28/2016	SeqNo: 346585							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium, Hexavalent	19.4	5.00	50.00	0	38.7	75	125				S

Sample ID: A1606234-010DMSD	SampType: MSD	TestCode: CR6-CWA	Units: µg/L	Prep Date:	RunNo: 25715						
Client ID: ZZZZZZ	Batch ID: R25715	TestNo: M 3500 Cr B	Analysis Date: 6/28/2016	SeqNo: 346586							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chromium, Hexavalent	17.6	5.00	50.00	0	35.2	75	125	19.36	9.39	20	S

Qualifiers: B Analyte detected in the associated Method Blank H Holding times for preparation or analysis exceeded ND Not Detected at the Reporting Limit Page 10 of 10
O RSD is greater than RSDlimit R RPD outside accepted recovery limits S Spike Recovery outside accepted reco

KEY TO FLAGS

Rev. May 12, 2010

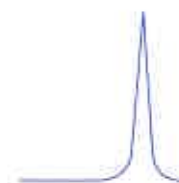
- A This sample contains a Gasoline Range Organic not identified as a specific hydrocarbon product. The result was quantified against gasoline calibration standards
- A1 This sample contains a Diesel Range Organic not identified as a specific hydrocarbon product. The result was quantified against diesel calibration standards.
- A2 This sample contains a Lube Oil Range Organic not identified as a specific hydrocarbon product. The result was quantified against a lube oil calibration standard.
- A3 The result was determined to be Non-Detect based on hydrocarbon pattern recognition. The product was carry-over from another hydrocarbon type.
- A4 The product appears to be aged or degraded diesel.
- B The blank exhibited a positive result great than the reporting limit for this compound.
- CN See Case Narrative.
- D Result is based from a dilution.
- E Result exceeds the calibration range for this compound. The result should be considered as estimate.
- F The positive result for this hydrocarbon is due to single component contamination. The product does not match any hydrocarbon in the fuels library.
- G Result may be biased high due to biogenic interferences. Clean up is recommended.
- H Sample was analyzed outside recommended holding time.
- HT At clients request, samples was analyzed outside of recommended holding time.
- J The result for this analyte is between the MDL and the PQL and should be considered as estimated concentration.
- K Diesel result is biased high due to amount of Oil contained in the sample.
- L Diesel result is biased high due to amount of Gasoline contained in the sample.
- M Oil result is biased high due to amount of Diesel contained in the sample.
- MC Sample concentration is greater than 4x the spiked value, the spiked value is considered insignificant.
- MI Result is outside control limits due to matrix interference.
- MSA Value determined by Method of Standard Addition.
- O Laboratory Control Standard (LCS) exceeded laboratory control limits, but meets CCV criteria. Data meets EPA requirements.
- Q Detection levels elevated due to sample matrix.
- R RPD control limits were exceeded.
- RF Duplicate failed due to result being at or near the method-reporting limit.
- RP Matrix spike values exceed established QC limits; post digestion spike is in control.
- S Recovery is outside control limits.
- SC Closing CCV or LCS exceeded high recovery control limits, but associated samples are non-detect. Data meets EPA requirements.
- * The result for this parameter was greater than the maximum contaminant level of the TCLP regulatory limit.

Page 2 of 2

Fax: 503-607-1336

Invoice To WFA P.O. No. _____

Relinquished By: <i>Ad SA</i>	Date: <i>9/28/10</i>	Time: <i>1310</i>
Company:		
Received For Lab By: <i>Nicky Brown</i>	Date: <i>10/28/10</i>	Time: <i>1310</i>



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07/12/2016

Specialty Analytical
11711 SE Capps Rd
Clackamas, OR 97015
Attn: Nikki Bippes

P.O.#: COD
Project: 1606234
Sample Matrix: Water
Date Sampled: 06/27/2016
Date Received: 06/30/2016
Spectra Project: 2016060943

<u>Client ID</u>	<u>Spectra #</u>	<u>Analyte</u>	<u>Result</u>	<u>Units</u>	<u>Method</u>
Filter Blank	1	Dissolved Sulfur	< 0.1	mg/L	SW846 6010C
FHC-GW-MW12A-23.0	2	Dissolved Sulfur	11	mg/L	SW846 6010C
QA-2	3	Dissolved Sulfur	13.3	mg/L	SW846 6010C

SPECTRA LABORATORIES

Steve Hibbs, Laboratory Manager

a7/scj

Communications Record

Internal Document

Client: Specialty Analytical

Client Contact: Nikki – 503 607-1331

Date: 06/30/16

Time: 3:13 p.m.

Spectra Contact: Lori Hamilton

Project: NYA 2016060943

Use Sample ID found on container: FHC-GW-MW12A-23.0 (Sample #2)

Sample ID found on Chain of Custody is incorrect.

APPENDIX D

DATA VALIDATION MEMORANDUM



DATA QUALITY ASSURANCE/QUALITY CONTROL REVIEW

PROJECT NO. 1162.01.03 | OCTOBER 19, 2016 | JH KELLY

Maul Foster & Alongi, Inc. (MFA) conducted an independent review of the quality of analytical results for groundwater samples collected from the former Frontier Hard Chrome site at 113 Y Street in Vancouver, Washington. The samples were collected on June 27 and 28, 2016.

Specialty Analytical (SA) and Spectra Laboratories (SL) performed the analyses. SA report number 1606234 and SL report number 2016060943 were reviewed. The analyses performed and samples analyzed are listed below.

Analysis	Reference
Anions	USEPA 300.0
Dissolved Sulfur	USEPA 6010C
Total and Dissolved Chromium	USEPA 6020A
Total and Dissolved Hexavalent Chromium	SM 3500-Cr

SM = standard methods for the examination of water and wastewater.

USEPA = U.S. Environmental Protection Agency.

Samples Analyzed	
Reports 1606234/2016060943	
FHC-GW-W8503B-24.0	FHC-GW-MW15A-24.0
Filter Blank	FHC-GW-MW12A-23.0
FHC-GW-W9216A-25.0	FHC-GW-12B-25.0
FHC-GW-9216B-25.0	QA-2
FHC-GW-MW15B-24.0	FHC-GW-MW12C-25.0
QA-1	FHC-GW-MW17A-24.0
FHC-GW-MW16A-25.0	FHC-GW-MW16B-25.0

DATA QUALIFICATIONS

Analytical results were evaluated according to applicable sections of USEPA procedures (USEPA, 2014), appropriate laboratory and method-specific guidelines (SA, 2015; SL, 2013; USEPA, 1986).

The data are considered acceptable for their intended use, with the appropriate data qualifiers assigned.

HOLDING TIMES, PRESERVATION, AND SAMPLE STORAGE

Holding Times

Extractions and analyses were performed within the recommended holding time criteria.

Preservation and Sample Storage

The samples were preserved and stored appropriately.

BLANKS

Method Blanks

Laboratory method blank analyses were performed at the required frequencies. For purposes of data qualification, the method blanks were associated with all samples prepared in the analytical batch.

All method blanks were non-detect for all target analytes.

Filter Blanks

One filter blank was collected during the sampling event. The filter blank water sample was analyzed for dissolved chromium, dissolved hexavalent chromium, and dissolved sulfur. The filter used was from the same batch number as the filters used for sampling. Laboratory-supplied deionized water was used for sample collection. All sample analyses were non-detect at or above the method reporting limit (MRL).

Trip Blanks

Trip blanks were not required for this sampling event.

Equipment Rinsate Blanks

Equipment rinsate blanks were not required for this sampling event, as all samples were collected using dedicated, single-use equipment.

MATRIX SPIKE/MATRIX SPIKE DUPLICATE RESULTS

Matrix spike/matrix spike duplicate (MS/MSD) results are used to evaluate laboratory precision and accuracy. All MS/MSD samples were extracted and analyzed at the required frequency.

As shown in report 1606234, the SM 3500-Cr MS/MSD total and dissolved hexavalent chromium results were both below acceptance criteria at 38.7 percent recovery and 35.2 percent recovery, respectively. The associated sample was qualified “UJ” as estimated and not detected at or above the MRL as follows:

Report	Sample	Analysis	Original Result (ug/L)	Qualified Result (ug/L)
1606234	QA-2	Dissolved hexavalent chromium	5.00 U	5.00 UJ
		Total hexavalent chromium	5.00 U	5.00 UJ

ug/L = micrograms per liter.

All remaining MS/MSD results were within acceptance limits for percent recovery and relative percent differences (RPDs).

LABORATORY DUPLICATE RESULTS

Duplicate results are used to evaluate laboratory precision. All duplicate samples were extracted and analyzed at the required frequency. Laboratory duplicate RPD exceedances were not qualified when laboratory duplicate results were detected at concentrations less than five times the reporting limit.

All laboratory duplicate RPDs were within acceptance limits.

LABORATORY CONTROL SAMPLE/LABORATORY CONTROL SAMPLE DUPLICATE RESULTS

A laboratory control sample/laboratory control sample duplicate (LCS/LCSD) is spiked with target analytes to provide information on laboratory precision and accuracy. The LCS/LCSD samples were extracted and analyzed at the required frequency.

All LCS/LCSD analytes were within acceptance limits for percent recovery and RPD.

FIELD DUPLICATE RESULTS

Field duplicate samples measure both field and laboratory precision. Two field duplicates (FHC-GW-MW15B-24.0/QA-1) and (FHC-GW-MW12A-23.0/QA-2) were submitted for analysis. MFA uses acceptance criteria of 100 percent RPD for results that are less than five times the MRL, or 50 percent RPD for results that are greater than five times the MRL. Non-detect data are not used in the evaluation of field duplicate results.

In report 1606234, the USEPA Method 6020A total chromium field duplicate RPD exceeded acceptance criteria. The sample and its field duplicate have been qualified as follows:

Report	Sample	Analysis	RPD	Original Result (ug/L)	Qualified Result (ug/L)
1606234	FHC-GW-MW12A-23.0	Total hexavalent chromium	65.7	7.48	7.48 J
	QA-2	Total hexavalent chromium		14.8	14.8 J

All remaining field duplicate RPDs were within acceptance limits.

CONTINUING CALIBRATION VERIFICATION RESULTS

Continuing calibration verification (CCV) results are used to demonstrate instrument precision and accuracy through the end of the sample batch. All remaining CCVs were within acceptance limits for percent recovery.

All CCV results were within acceptance criteria.

REPORTING LIMITS

SA and SL used routine reporting limits for non-detect results, except for samples requiring dilutions because of high analyte concentrations and/or matrix interferences.

DATA PACKAGE

The data packages were reviewed for transcription errors, omissions, and anomalies.

In report 2016060943, SL noted that the sample identification on one of the sample bottles submitted for dissolved sulfur analysis did not match the chain of custody from SA. The sample identification on the container was the intended sample for analysis (FHC-GW-MW12A-23.0, field duplicate to SA-2) and reported correctly. No action was necessary.

No other issues were found.

REFERENCES

- SA. 2015. Quality assurance manual. Specialty Analytical, Clackamas, Oregon. January.
- SL. 2013. Quality assurance manual. Spectra Laboratories. February.
- USEPA. 1986. Test methods for evaluating solid waste: physical/chemical methods. EPA-530/SW-846 Update V. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. September (revision 1, July 2014).
- USEPA. 2014. USEPA contract laboratory program, national functional guidelines for inorganic Superfund data review. EPA 540/R-013/001. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation.